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"Drones-as-a-Service (DaaS) – An analysis of the Operator as Service Provider and its potential liabilities under light of Regulation (EU) 2019/947"

Pablo Romero Nieto
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Tiivistelmä – Referat – Abstract

Giving the consolidation of a framework that allows for the operations of drones for commercial purposes by the new implemented Regulation (EU) 2019/947 on the rules and procedures for the operation of unmanned aircraft, this thesis introduces the reader to both the origin of the technology, the potential business applications of drones in the civil environment, and the current provisions regarding the risk-based operational characteristics of the Regulation as means to analyse the previously existing air and contractual law's provisions. Through the exploration of the relevant legal principles and regulatory guidelines available for the interpretation of liability assignment and applicability, and by comparing the regulation to the contractual model in order to provide a deeper understanding of how the technology can be commercialized on a Drone-as-a-Service model, the author presents the relevant need of further legislation addressing the application of liability regimes harmonization between Member States from the perspective of the Unmanned Aircraft Systems Operator to satisfy the modern Cloud-Based Services Agreements model and allow the use of Internet as a platform for cross-jurisdictional performance.

The first chapter revolves around the historical development and the growing civil interest in the application of drones to activities as a novel, as well as to already established activities that are currently performed by different technologies. Furthermore, it presents the possibility of its characterisation under the framework currently employed by cloud-based services regarding its commercial contractual format.

The second chapter focuses on introducing the new Regulations (EU) 2019/947 and 2019/945, which have set the legal and regulatory frame for the safe conduction of activities of unmanned aircrafts, including the principles that served as base for the development of the provision;, the operational rules; machinery requirements and classifications; and the categories' classification system that have been created for risk assessment. Overall, the frame serves as a guide for anyone interested in venturing in this business.

The third chapter explores the international laws and EU air laws that will influence the ruling and potential jurisprudence regarding liability decisions. It aims at presenting both the relevance of Member States autonomy over regulatory decisions and importance towards contractual liabilities disputes. The focus is strongly focused on Operators that will be employed by service providers under the conceptualised cloud-based services agreements contracts framework.

Finally, the thesis presents its conclusions and recommendations towards the commercial parties and legislators.

Avainsanat – Nyckelord – Keywords

Contract Law, EU Regulations, Regulation (EU) 2019/947, Unmanned Aircraft Regulations, UAR, Unmanned Aircraft Systems, UASs, Civil Drones, Drones Regulations, Drones-as-a-Service, DaaS, Air law, Liability, Liability Regimes, Cloud-Based Services.

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GLOSSARY

AMC	Acceptable Means of Compliance
ATM	Air Traffic Management
BVLOS	Beyond Visual Line of Sight Operation
CAA	Danish Civil Aviation Authority
CAB	Civil Aeronautics Board
CE marking	*Conformité Européene* marking
CESL	Common European Sales Law
CLC	International Convention of Civil Liability for Oil Pollution Damage
DaaS	Drone-as-a-Service
EASA	European Aviation Safety Agency
EC	European Council
EU	European Union
FUND	International Convention on the Establishment of an International Fund for Compensation for Oil Pollution Damage
GCS	Ground Control Station
GDPR	General Data Protection Regulation
GM	Guidance Materials
IaaS	Infrastructure-as-a-Service
ICAN	International Commission for Air Navigation
ICAO	International Civil Aviation Organization
IEEE	Institute of Electrical and Electronics Engineers
IoT	Internet of Things
JARUS	Joint Authorities for Rulemaking on Unmanned Systems
LUC	Light UAS Operator certificate
MS	EU Member State
MTOM	Maximum Take-off Mass
NAA	National Aviation Authority
PaaS	Platform-as-a-Service
PDRA	Pre-defined risk assessment

RC	Remote-Controlled
RPA	Remotely Piloted Aircraft
RPAS	Remotely Piloted Aircraft Systems
SaaS	Software-as-a-Service
SES	Single European Sky
SESAR	Single European Sky Air Traffic Management Research
SJU	SESAR Joint Undertaking
SORA	Specific Operation Risk Assessment"
UAS	Unmanned Aircraft Systems
UAV	Unmanned Aerial Vehicle
USA	United States of America
UTM	Unmanned Traffic Management
VLOS	Visual Line of Sight Operation

INTRODUCTION

Modern problems require modern solutions, and in order to achieve them, a growing number of companies have focused their efforts and, sometimes, even devoted their existence to the supply of innovative products capable of achieving the new expectations of the consumer market. Some of those companies are world renowned corporations with substantial resources but the majority of risk-takers in the game are start-ups which have heavily relied on internet-based operations due its lower operations costs, in both creation and maintenance.

The main reason start-ups are considered risk-takers is due to their lesser capability of devoting resources to satellite-issues arising out of the commercialisation of their product. It is popularly believed that having a good product is enough to create a successful company. In essence is true, but in reality, other challenges may impose tolls that can kill a business even prior to reaching the market. A fairly common example of that, is the high cost of insurances, the difficulty to secure loans on innovation, as well as the personal liability an entrepreneur may be required to assume when investing in the business.

On the one hand, increasingly high prices of manufacturing and production aligned with monopolisation of the available resources by already established companies have discouraged new business from entering such traditional production markets, considering that in order to compete with the dominant players, smaller companies would have to devote their efforts to research and development of new technologies in an environment where most of the original baseline patents have already been filed by competitors, e.g. radio patents applied to smartphones, manufacturing and Wi-Fi; on the other hand software development solutions for both B2B[1] and B2C[2] have shown to be a profitable market where the initial investment is focused on a combination of labour forces and infrastructure, while the remaining resources are focused on pushing sales of subscriptions to the software platform, up-keeping technical support, and services (e.g. data collection and processing). Another advantage of utilising a software development-based business is the turnover volume, as by signing a business you may have a lot more users, and therefore sold subscriptions, than if commercialising solution to consumers.

[1] Wendy Connick, 'The Difference Between B2B Sales and B2C Sales and How They Work' (The Balance Careers, 2019) <https://www.thebalancecareers.com/what-is-b2b-sales-2917368> accessed 20 September 2019. It refers to sales you make to other businesses rather than to individual consumers. Sales to consumers are referred to as 'business-to-consumer' sales or B2C.'
[2] Ibid.

That is the introduction to the concept of Cloud Computing[3], which is an essential component in understanding what kind of contractual services, and clauses will be applicable to the business model of Drone-as-a-Service (DaaS).

For this thesis purposes, the exploration of DaaS will be focused on non-military commercial applications only and will not address the transportation of passenger, even though this activity will also be influenced by the provisions of UAS Regulation[4], the carrying of passenger aims at a much more elaborate scenario, where the operations will probably be in similar altitudes to commercial aircrafts, consequently, the risks will be higher and the need to further regulate will probably arise. Furthermore, liabilities and contractual characteristics have already been extensively implemented for transport of passenger in the aviation sector, as well as where DaaS for transport will eventually be a reality, it is currently still in the development phase, therefore studying it the legal aspects deeply will result in vague theoretical work, while the study of DaaS for services purposes is already a reality with real life case consequences.

Questions such as - Why DaaS is the best model alternative?; How the development of operations has been defined under the new framework set by Regulations 2019/945 and 2019/947?; and, What influences the international air law body of rules that reign civil responsibilities reflect on Operators liabilities by existing legislation? – will be used to build and conclude a new perspective on commercial exploration of drones by both Operators and service providers, which in many instances will be the same person.

Considering the recent introduction of regulatory laws towards drone's operations, such as classification and assignment of obligatory requirements and the creation of national agencies to deal with drone operations matters, there has never been a more relevant time to explore the commercial possibilities of this technology. Furthermore, since Operators will be the most interested parties it is only natural to approach the implication they will face under the new scenario.

Liabilities and indemnities are two contractual obligations in between the parties to a contract. Therefore, if there is a commercial relationship there is also a contractual obligation (written or verbal), these two obligations are usually the largest hidden risks and warranties available in such

[3] Steve Ranger, 'What Is Cloud Computing? Everything You Need to Know About the Cloud, Explained | Zdnet' (ZDNet, 2018) <https://www.zdnet.com/article/what-is-cloud-computing-everything-you-need-to-know-from-public-and-private-cloud-to-software-as-a/> accessed 7 April 2019.
[4] Implemented Regulation (EU) 2019/947 of the European Commission of 24 May 2019 on the rules and procedures for the operation of unmanned aircraft, commonly referred to as 'UAS Regulation'.

relationships. Curiously, liabilities don't exclusively refer to the responsibilities that arise out of performance of activities, but also to various obligations a party may have assumed under a binding agreement.

In a simplified cloud-based service agreement contract between two parties, these topics can usually be easily negotiated because, independently of what type of software subscription one party is selling, the outcomes of negligence are foreseeable and therefore the risks and damages are quantifiable, but since drones are classified as Unmanned Aircraft System (UAS), DaaS business contracts are not singularly limited to the contract aspects of commercial law. Ultimately the assumed contractual obligations have to obey the principles and regulations set by the air and aviation regulatory bodies, hence, in order to be able to assess the liabilities and indemnities under DaaS we need to evaluate the impact of applicable legislation on UASs in comparison to the treatment provided by air law to commercial aircrafts, such as international treaties, EU legislation (regulations and directives), and lastly, national and domestic civil laws.

Through the filtering of two implementing regulations regarding Unmanned Aircraft Systems (EU 2019/947 and 2019/945) and the analysis of how they can behave under a Cloud Computing based contractual format, this thesis intends to unveil an overlooked aspect of the relationship of B2B Drone's Operators, more specifically what can a DaaS Operator expect to influence their liabilities from both regulatory and contractual perspectives.

METHODOLOGY

It is known that the field of law relies on different methods of research, each appropriate for different formats of exploration that intend to present specific results. While the definition of the word "research" can be disputed, C.R. Kothari, states that it can be defined as an "art of scientific investigation"[5], whereas through careful search for new facts it is possible to systemise efforts in order to gain new knowledge.[6] Furthermore, according to Clifford Woody, "research comprises of redefining problems, formulating hypothesis or suggested solutions, collecting, evaluating organising and evaluating data; making deductions and reaching conclusions"[7].

The objective of the research is to describe an overlooked aspect, which is an indirect result, of a new legal text proposed and implemented by the European Union regarding regulatory requirements for safe operations of Unmanned Aircrafts and the consequent harmonisation of the industry within the European territory. The idea that drones, or Unmanned Aircrafts, needed regulation was already obvious to the legislative, but when developing such provisions, the civil liabilities of Operators were not directly defined. Said situation requires further analysis and deeper understanding of the existing history, legislation and jurisprudence that concern the subject matter.

Although it the majority of this thesis utilises a legal dogmatic approach, it is essential to understand that the final result aim is not limited to the identification of necessary future legal measures, but also intends to present an understandable scenario for business-minded professionals that intend to navigate the provisions and make informed decisions when calculating risks and setting strategies. Therefore, in certain cases it will be possible to identify hints of pragmatism being used to illustrate certain theories and provide a clear picture for the non-legal reader.

Indeed, the legal dogmatic approach "implements a method that systematically and analytically evaluates the law as it is transcribed"[8]. Furthermore, it describes five core elements: the collection of

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[5] C. R. Kothari, *Research Methodology: Methods And Techniques* (2nd edn, New Age International Ltd 2004)1,
[6] Ibid.
[7] Clifford Woody, 'The Values Of Educational Research To The Classroom Teacher' (1927) 16 The Journal of Educational Research.
[8] Laurence Sean Lawson, 'What Will Be The Future Of Data Flows Between The EU And The UK Post-Brexit?' [2018] HULib <https://pdfs.semanticscholar.org/33a2/b04d0bebfb2673c039cf26095636acfde7ad.pdf> accessed 14 April 2020.

legal assumptions;[9] the assumptions regarding the object of the laws;[10] admissibility of laws;[11] methodological rules surrounding the movement from sources to interpretation;[12] the number of value assumptions[13].[14]

Through a descriptive method the thesis introduces the reader to the history of the drones, the possible real-life benefits and the actual risks that the manipulation and commercialisation of them might create, as means to justify the legislative efforts employed regulate the activity. Once that has been achieved, it sets ground for familiarisation with the new aspects of the law. Where, through a dogmatic presentation of both the Implemented Regulation (EU) 2019/947 of the European Commission of 24 May 2019 on the rules and procedures for the operation of unmanned aircraft; and the Delegated Regulation (EU) 2019/945 of the European Commission of 12 March 2019 on Unmanned Aircraft Systems and on third-country Operators of Unmanned Aircraft Systems, the reader is introduced to the regulatory nature of Unmanned Aircrafts operational activities.

Since the paper is intended to assist anyone interested in venturing in a new business model the following chapters continue by ascertaining the regulations while highlighting the ambiguities that can be explored under different situations, trying to achieve a pragmatic response from the reader, who will hopefully see the value in the analysis and be able to apply the knowledge in business related decision making.

Another important aspect of the research is the motivation that inspired it. While it is not uncommon for thesis to approach changes in regulations, or the creation of new provisions, it is rare to encounter a comparison focused in explaining how such changes will affect a specific subject from a business perspective. There are several different articles by independent writers and even studies by consultancy and law firms, but it is unusual for academics to choose this approach.

Given my work-related experience and future professional goals, I propose to merge the academic analysis with an introduction to the pragmatic needs of the business world. Whereas the text of the law is indispensable for compliance reasons, the strategies in which such compliance may be executed under commercial applications is completely susceptible to the business Operator' choice. Hence,

[9] Ibid.
[10] Ibid.
[11] Ibid.
[12] Ibid.
[13] Ibid.
[14] Álvaro Núñez Vaquero, Five Models of Legal Science, Revus, 19,2013, pg. 53-81.

even though the descriptive analysis of regulatory and air law may dictate parts of the reality of this study, an empirical approach to contractual law enables the subjects of choice and strategic applicability (when defining liabilities, for example).

Where it is necessary to observe the existing rules, it is also important to recognize that jurisprudence may vary depending on the case and judge's opinion. The result being both the opportunity for problem solving creation and a service to society.

In terms of sources, this thesis primarily relies upon a compilation of EU law, Member States national laws, international treaties and independent contributors that have recently been exploring new applications of contract law for Internet-based solutions.

Given its dual nature, somewhere between legal and business, and the unlimited possible scenarios, this author has committed to remain as impartial as possible, by humbly presenting existing scenarios and pointing out possible outcomes but leaving the final decision to the reader, as by combining the scenarios with the available methods, the one is able to present an educated guess and arrive at a similar conclusions to the ones presented at the final conclusion.

1. DRONE ORIGINS

This chapter intends to provide background on the creation of unmanned aircrafts, popularly known as drones, the legal consequences of the public reach, and further exploration to this technology. More specifically, the adaptation of previous legislation, the creation of new rules for the citizens' safeguard and management of activities for both private and public bodies, and, finally, the popularization of the technology through the cloud-based solutions model. Even though Remotely Piloted Aircrafts (RPAs)[15] had a start within the military environment, this thesis will limit itself to the non-military aspects of the technology, by analysing how the RPAs can be explored in the UAS frame.[16]

Inventions and innovations often present themselves through combination of new solutions, challenges, and sometimes dangers, some can be framed under existing laws, like computer programming was eventually granted the recognitions of copyrights law, and others need an entirely new set of rules. For the industry's benefit, unmanned aircrafts have a lot in common with crewed aircrafts, having their main differences regarded towards the operations and commercialisation, rather than the fundamental nature of their existence.

The first step of the analysis will be to assess the origin and commercial application, while the later chapters will focus on the regulatory framing of UASs operations and the current understanding regarding applicable liability assignment and regimes.

Finally, the terminations regarding drones will be further explained in Chapter 2, but for the benefit of the reader, RPAs means "remotely piloted aircrafts"[17], while UASs means Unmanned Aircraft Systems[18], and refers to the a more complex set, composed by the aircraft, the Ground Control Station (GCS)[19] and the Operator, which is not necessarily the remote pilot, as in this situation one GCS may support a number of remote pilots conducting simultaneous operations, or even an automated software that has been pre-tested and authorized.

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[15] 'Drone, UAV, UAS, RPA or RPAS'. 'The terms Unmanned Aircraft (UA) or Remotely Piloted Aircraft (RPA) are used to describe the aircraft itself, whereas the term Unmanned Aerial System (UAS) is generally used to describe the entire operating equipment including the aircraft, the control station from where the aircraft is operated and the wireless data link.' (AltiGator Drone & UAV Technologies, 2019) <https://altigator.com/drone-uav-uas-rpa-or-rpas/> accessed 21 November 2019.

[16] Ibid.

[17] Ibid.

[18] UAS Regulation, Recital (2).

[19] 'Asseco UAS - Unmanned Aerial System | Ground Control Station' (*Uas.asseco.com*, 2020) <https://uas.asseco.com/ground-control-station/> accessed 7 June 2019.

1.1.CREATION AND PUBLIC REACH

Even though the goal is to focus on the civil and commercial approach of UAS it would be imprudent to ignore the military's influence in the establishment of what we recognize as a commercial drone. Much like other innovations, UAS have had many different contributors throughout its creation process, but military applications certainly had a vast impact on the development of the technology, with special attention to the large sums of financial investment.

Masutti and Tomasello[20] trace back military application for drones to 1849, when the Austro-Hungarian Army laid siege to Venice, in attempt to attack they launched a fleet of unmanned free balloons loaded with explosive, although at that time the term "drone" had not yet been created. According to the same authors, the most probable origin of the term was derived from the unmanned fixed wing aero planes, such as the "Kettering Bug"[21] in 1917 and a later modification of it known as the "Tiger Moth"[22] manufactured by De Havilland in 1935[23], both attempted to create a possible radio-controlled aircraft to serve as aerial targets to train fighter pilots for air-to-air combat, resembling a queen bee being chased by drones in nature, hence the denomination "drone"[24]. Nowadays the term the "queen bee"[25] is no longer used to identify a target, instead the concept has evolved to a controller issuing order and patterns of flight to an RPA[26].

Years later, around 1991, "during the war in the Persian Gulf, The US military services, and their allies realized that the potential of drones for military applications was wide ranging. Following these experiences, the manufacturing industry not only increase the production of military drones, but soon started to promote their civil use"[27].

The military is largely responsible for the development of drone technology, but it did not allow the civil commercialisation of the technology alone. Much of what has been achieved is credited to the creation and patent filing of the first radio-controlled (RC) aircrafts. According to Kashyap, the "Radioplane OQ-2, was developed by Reginald Denny during World War II actually became the first mass-produced UAV product in the U.S. Nearly 15,000 drones were manufactured for the army

[20] Anna Masutti and Filippo Tomasello, International Regulation Of Non-Military Drones (1st edition, Edward Elgar Publishing Limited 2018), 22-25.
[21] Ibid., 22
[22] Ibid.
[23] Ibid.
[24] Ibid.
[25] Ibid.
[26] Ibid., 24.
[27] Ibid., 23.

during the war. However, the actual credit for inventing a radio-controlled aircraft that could fly out of sight goes to Edward M. Sorensen, whom patented his invention allowing a remote-pilot to know what the air-borne device is doing from a ground terminal. Without these patents, early RC aircrafts could only operate within the visual sight of the controlling pilot"[28].

As presented, the military has been the catalyst in the development of UAS technology, which has allowed commercial drones to "become, cheaper, lighter, and more sophisticated"[29]. In light of that, nowadays drones have outgrown the original role of "delivering payloads in foreign land"[30] by reaching new possible purposes, that according to Reuters[31], are predicted to achieve as much as "$14.3 billion in sales over the next decade"[32], with application in the a variety of sectors, such as: "agriculture, construction, real state, applied sciences, law enforcement, media, mining, private security, search & rescue, wildlife conservation"[33], and more.

1.2.COMMERCIAL APPLICATIONS

The broader reaches of UAS functions and the cheaper prices of both components and ready-to-use drones, have allowed for the widespread adoption of the technology by the general population with significant growth in sectors independent from the military. Either through the purchase or independent assembling of personal drones, owned by private citizens or without commercial purposes, and also through the purchase of commercially purposed RPAs, the global market has identified several sectors where the adoption of drones as a product can be replaced as a better alternative for services delivery.

To support that statement, a research study from the Institute of Electrical and Electronics Engineers (IEEE), has found that "the use of unmanned aerial vehicles (UAVs) is growing rapidly across many civil application domains including real-time monitoring, providing wireless coverage, remote

[28] Kashyap Vyas, 'A Brief History Of Drones: The Remote Controlled Unmanned Aerial Vehicles (UAVs)' (Interestingengineering.com, 2018) <https://interestingengineering.com/a-brief-history-of-drones-the-remote-controlled-unmanned-aerial-vehicles-uavs> accessed 26 October 2019.
[29] Jeff Desjardins, 'Here's How Commercial Drones Grew Out Of The Battlefield' (Business Insider, 2016) <https://www.businessinsider.com/a-history-of-commercial-drones-2016-12?r=US&IR=T> accessed 26 October 2019.
[30] Ibid.
[31] Bryan Pietsch, 'Global Drone Market Estimated To Reach $14 Billion Over Next Decade: Study' (Reuters, 2019) <https://www.reuters.com/article/us-usa-security-drones/global-drone-market-estimated-to-reach-14-billion-over-next-decade-study-idUSKCN1UC2MU> accessed 26 October 2019.
[32] Ibid.
[33] Jeff Desjardins, 'Here's How Commercial Drones Grew Out Of The Battlefield' (Business Insider, 2016) <https://www.businessinsider.com/a-history-of-commercial-drones-2016-12?r=US&IR=T> accessed 26 October 2019.

sensing, search and rescue, delivery of goods, security and surveillance, precision agriculture, and civil infrastructure inspection"[34].

One interesting example of that is the possibility to replace manned aircrafts in the agricultural sector, with purposes such as mapping fields and the protection of crops through pesticide application, where originally a company or farmer would need to resort to an expensive investment that includes the hiring of a plane, fuel, a qualified pilot and the specific optical technology, it is now possible to execute the same service through a drone, where the previous costs are much lower regarding all of the above-mentioned requirements. In Antwerp, for example, "hospitals are using drones to carry out medical transports, such as blood and urine samples, and even medicines"[35], while in Helsinki, "Alphabet launched a food delivery service by drones"[36].

Another relevant example is private surveillance. There are several applications of a drone within the definition of "tracking and surveillance"[37] that don't have to do with the military sectors, such as ships & harbour' cargo inspections, industrial site surveillance and rescue missions, to name a few. Traditionally, in order to have a somehow reliable result of these services the business needs to spend its resources in hired employees, which result in a waterfall of hidden costs. For each employee the company needs to disburse the costs of salary, tax contribution, health and safety, holidays and employer's liability, but even with all these expenses there is no guaranteed warranty of execution, as humans have flaws and therefore may execute incomplete or failed assessments while on duty. The described activities present significantly lower challenge and risk when operated by machines, as drones are not subject to human emotion (partiality). employment laws or danger to life, therefore presenting a welcoming tool for the execution of repetitive and risky functions,

One of the most common shared concerns between employees is in fact the fear of being replaced by machines, but the drone's industry appears to be promising with prospects for growth both for the

[34] Hazim Shakhatreh and others, 'Unmanned Aerial Vehicles (UAVs): A Survey On Civil Applications And Key Research Challenges' (2019) 7 IEEE Access <https://arxiv.org/pdf/1805.00881> accessed 26 October 2019.
[35] Steven De Schrijver, 'Commercial Use Of Drones: Commercial Drones Facing Legal Turbulence: Towards A New Legal Framework In The EU' (2019) 16 US-China Law Review, 340.
[36] Ibid.
[37] Hazim Shakhatreh and others, 'Unmanned Aerial Vehicles (UAVs): A Survey On Civil Applications And Key Research Challenges' (2019) 7 IEEE Access <https://arxiv.org/pdf/1805.00881> accessed 26 October 2019.

manufacturing industry and for future users of drones, therefore creating new jobs and even professions previously unheard of.[38]

Since profitability is within the core of commercial business, the possibility of having more reliable and cheaper services that will cut operating costs is a welcome prospect. Therefore, the sectors have an increasing demand for the service, leading to a need for supply. Ultimately demand and supply will dictate the large-scale commerciality of a product.

Besides financial costs, another important application of UAS is the safety implications in the safeguard of human life. From a humane perspective drones offer another advantage, the possibility to execute dangerous actions without risking the life of the remote pilot. In both previously listed examples there are instances where drones can be a safer option, such as the replacement of qualified pilots, within pesticide applications, and the dispatch of trained professionals for search in rescue missions.

All those factors have presented as essential towards the spread of the UAS technology, but historically every new creation can result in further ramifications. In-between the many consequences of this growth it is understandable that governmental authorities have identified an increase in concern with the safety and protection of the general population. After all it is a government's duty to regulate and enforce safety parameters, not only for already established technologies, but especially for innovations such as UAS.

1.3.DRONES-AS-A-SERVICE (DAAS) CONCEPT

Now that the origin and the commercial application of drones have been presented, the author intends to explain the reason for cloud-based solutions have been the chosen commercial model for the execution and delivery of services by drones' Operators. While the commercial applications of drones are mostly focused on the B2C solutions, the concept of DaaS[39] can be broader, it is presented as the industrial exploration of UAVs for commercial purposes through the application of cloud-based services solutions models to address different aspects of the business, both the structural organisation and the sales enterprises. For clarification purposes, the concept of DaaS is presented as a new model that combines the characteristics of an existing commercial framework in order to explore a

[38] Riga Declaration on Remotely Piloted Aircraft (drones) 'Framing the Future of Aviation', Latvian presidency of the Council of the European Union, Riga (2015), 1.
[39] Lars Dibbern, 'Drones As A Service - Dibbern Consulting' (*Dibbern Consulting*, 2016) <https://www.dibbern.biz/drones-as-a-service-a-professional-it-service-provision/> accessed 7 April 2020.

technological innovation in an optimised way and deliver a final product, where an Operator will provide services to customers in different industries under the same contractual model but tailored to their individual needs.

According to Rouse[40], "Cloud Computing is a general term for anything that involves delivering hosted services over the Internet. These services are broadly divided into three categories: Infrastructure-as-a-Service (IaaS), Platform-as-a-Service (PaaS) and Software-as-a-Service (SaaS)"[41]. That is the first step in understanding what DaaS constitutes, but it is not the full picture, as within the model one may encounter all three Cloud Computing platforms delivered in a variety of options tailored to the needs of the customer, in this instance the client is the one hiring the service and can be both another business or a consumer. Furthermore, the idea of hosting services over the internet can have more than one meaning, for example within DaaS a provider can offer the management and operation of drones through subscription as well as the creation of a local network to be operated by the customer which, combined or separately, will also require a master agreement and further upkeep subscription services. Therefore, the idea of Internet in this context is broader than the traditional understanding, in different words; DaaS it is not necessarily limited to the remote use of online software services, but rather the combination of Internet based solutions.

As previously stated, "Cloud Services" is used as a denomination to identify the 3 different concepts Cloud Computing commercial agreements, SaaS, PaaS and IaaS. According to Dover and Mohr, Software-as-a-Service model (SaaS) is currently the most commonly used, "Under this model, a user is given access to a provider's software over the internet, usually for a monthly subscription fee."[42] SaaS is used as an alternative to the usual purchase of licenses of software, instead of owning the product and having it installed on-site, the user pays for the right to online use.

Another service model is Infrastructure-as-a-Service (IaaS). "With IaaS, a service provider provisions fundamental computer capabilities such as processing or storage, and offers pools of IT infrastructure resources, like servers, storage or other network components on a pay-per-usage basis.[43]" In this

[40] Margaret Rouse and Stephen J. Bigelow, 'What Is Cloud Computing? - Definition From Whatis.Com' (SearchCloudComputing, 2019) <https://searchcloudcomputing.techtarget.com/definition/cloud-computing> accessed 20 September 2019.
[41] Ibid.
[42] Tony Hou, 'IaaS vs PaaS vs SaaS: What You Need To Know + Examples (2018)' (The BigCommerce Blog) <https://www.bigcommerce.com/blog/saas-vs-paas-vs-iaas/#the-three-types-of-cloud-computing-service-models-explained> accessed 22 November 2019.
[43] Michael R. Dover and Robyn P. Mohr, 'Practical Legal Considerations When Thinking About Cloud Computing' (CCBJ, 2015) <https://ccbjournal.com/articles/practical-legal-considerations-when-thinking-about-cloud-computing> accessed 22 November 2019.

model, “the cloud service provider owns the equipment and is responsible for the housing, cooling, operation and maintenance of its systems. IaaS gives users cloud-based alternatives to on premise infrastructure, so businesses can avoid investing in expensive on-site resources.[44]”

The last service model is the cloud Platform-as-a-service (PaaS). “Under this model, the service provider gives the customer access to a full-functioning computing and solution stack on which user-created applications (with provider-supported programming languages and tools) are deployed. Under the PaaS model, customers typically pay only for the services used.[45]” According to Hou, “PaaS is primarily used by developers who are building software or applications. This means developers don’t need to start from scratch when creating applications, saving them a lot of time (and money) on writing extensive code. PaaS is a popular choice for businesses that want to create unique applications without spending a fortune or taking on all the responsibility.[46]”

DaaS is particularly interesting because it can both be developed through cloud service solutions and deployed through it. The prime reason for business to choose this model of services contracting is linked to the cost and efficiency results that can be achieved. In the current scenario, a DaaS Provider can employ cloud-based solutions to provide services in different phases of its business, for example they could offer the delivery of data collection to customers under a SaaS based contract, while relying on IaaS based contract for their own business operations.

There are several different components that amount to the end product, for the most simple execution, there needs to be an RPA and a remote pilot, while for more elaborate operations it may be necessary to have a fleet of RPAs, several remote pilots, and a private network to host and manage the operation.

SaaS can be used to create and offer a remote pilot database, collect and process data and even to host the operations management, in a scenario where the customer owns the RPAs, already have its own remote pilots and its own private network, but still needs a software to conduct safe operations and mitigate the risks. IaaS can be used when the customer already has all of the above but is missing

[44] Tony Hou, 'IaaS Vs PaaS Vs SaaS: What You Need To Know + Examples (2018)' (The BigCommerce Blog) <https://www.bigcommerce.com/blog/saas-vs-paas-vs-iaas/#the-three-types-of-cloud-computing-service-models-explained> accessed 22 November 2019.
[45] Michael R. Dover and Robyn P. Mohr, 'Practical Legal Considerations When Thinking About Cloud Computing' (CCBJ, 2015) <https://ccbjournal.com/articles/practical-legal-considerations-when-thinking-about-cloud-computing> accessed 22 November 2019.
[46] Tony Hou, 'IaaS Vs PaaS Vs SaaS: What You Need To Know + Examples (2018)' (The BigCommerce Blog) <https://www.bigcommerce.com/blog/saas-vs-paas-vs-iaas/#the-three-types-of-cloud-computing-service-models-explained> accessed 22 November 2019.

private network. PaaS can be used when the customer also has met all the previously mentioned requirements but needs to rely on alternative methods of privacy and cyber protection, for example.

Where a traditional approach would demand the involvement of a number of suppliers, developers and subcontractors to operate the implementations on-site, through this service the Operator would rely on simplified and cheaper solutions offered through the Internet.

Depending on the operational level, an Operator will need different tools to execute the service. As previously mentioned, Operators have a series of requirements prior to the execution and approval of airborne operations, it can be related to environment assessment or remote piloting credentials, for example. In this instance the Operator could potentially rely on a SaaS subscription solution where, through data input, they would be able to assess the risk and guarantee that the remote pilot has the legally required certifications for the execution, in a way the service provider would be offering a database with processing capabilities to address the needs of the Operator. If the remote pilot independently uploads and warrants that all the information is true, and later it is discovered that there were misleading and or incorrect information, the Operator would be the direct liable party, but could later be entitled to claim an indemnification from the remote pilot.

The advantage of this concept is that the service provider only sells the use of an online software platform and therefore is not liable for any uploaded information, possesses a lower risk of litigation and exemption of warranty by the supplier resulting in a cheaper service for the DaaS Provider. The same online software can be made available for a multitude of companies that have similar needs, whereas the data can be reused countless times under the initial investment to create the software. Altogether the service provider is able to both cut costs by extending the lifespan of their product and achieving profit through the promotion of use by more than one subscriber, as well as the stipulation of prices for different use cases. As an example, it can set a lower price for the remote pilot database access and a higher price for the risk calculation of operations. Similarly, a customer could hire a subscription from a DaaS Provider to regularly conduct a detailed geographical area survey intended for agricultural data collection and processing. Originally, the same service would involve hiring an airplane, a pilot, and the technology necessary to conduct the operation, but the DaaS Provider can achieve the same result and maintain the services for a substantially lower price. Instead of an airplane and a pilot, it will only need an appropriate drone and an Internet connection to run its processing software.

Another potential use of this model is its characteristically "tailored to need" availability. Each company has their own internal tools, which usually demands some adaptation to properly function with external software. Once a customer and the service provider find their systems synchronised, the option to further implement the symbiotic relationship usually surfaces, in those cases, the products already exist, but further development needs to be created in order to fully explore the potential of the partnership. In this case, the service provider has already gone through extensive development to create their product and probably hold many tools that the Operator can use for further development. In a traditional format the service provider could license those tools to the Operator, but licensing generally includes providing IP warranties and tech support, resulting in heavy financial burdens for the licensor, who will have to make sure that all of the patents and solutions are error free, directly reflecting on the price a licensee will be charged. The SaaS use case is quite upfront and usually used on a matured phase of the business, it is mostly delivered "as is" but as previously stated it can be made to address specific needs of the client.

There are other ways DaaS can implement cloud-based solutions, one example is privacy and cyber security. While drones make easier to collect data, at the current stage of technological development there are no commonly used security tools integrated into either software or hardware. Considering the operational risks and the other regulatory requirements, such as the GDPR[47], an Operator would be required to implement certain measures to achieve the legal requirements for operations. Instead of devoting resources to independent development of a complex security system, the Operator can opt for a PaaS solution, where a series of software solutions for privacy and cyber defence has already been developed and are available to customisation. Besides saving expenses by decreasing allocation of financial resources towards the development of new software, by electing a service that is widely used, such as Microsoft Azure[48] for built-in security controls, the Operator will also be able satisfy regulatory authorities by declaring easy to understand and tailored protective measures that are created exactly to comply with industry standards. After all, one of the strong points of PaaS solutions is that it is developed in a way to both satisfy the customer and international regulatory standards.

[47] Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, and repealing Directive 95/46/EC

[48] 'Azure Security | Microsoft Azure' (Azure.microsoft.com, 2020) <https://azure.microsoft.com/en-us/overview/security/> accessed 7 July 2019. 'Reduce costs and complexity with a highly secure cloud foundation managed by Microsoft. Use multi-layered, built-in security controls and unique threat intelligence from Azure to help identify and protect against rapidly evolving threats.'

A consequence of using PaaS as complementary solutions is that the individual liabilities of both the service provider and the client are easily identifiable, for instance the service provider is only responsible for the offered tools while the client is responsible for how they are used, in other words, there is a somewhat shared liability, but assignment is easily deduced. The client will be responsible for the final product and all of its contributions and the service provider is responsible for the content and programs that it has made available.

So far, the presented use-case examples have been focused on an administrative operational scenario, where the Operator already owns the RPAs and can independently operate them, only using the services to address satellite-requirements for smaller operations, but there is also an opportunity to use cloud-based services in a much larger scale.

In large scale operations the regulatory requirements would be much higher, such as the deployment and management of a fleet with simultaneous complex airborne operations. Where, in order to safeguard the delivery of a mitigating measures plan, the Operator would necessarily have to guarantee that not only all the Unmanned Aircrafts are in compliance with the class' hardware requirements, but also that the remaining infrastructure of the Unmanned Aircraft Systems is in compliance with the operational regulatory provisions.

In order to satisfy those requirements, the Operator can resort to IaaS solutions, where the service provider doesn't necessarily offer exclusively online products, but the connectivity infrastructure itself. The definition of IaaS is more complex compared to the other two models, in the sense that IaaS requires the service provider to deliver on site hardware, but in reality, the Internet-based characteristic is still present. This model is broadly present in the "Internet of Things" [49] (IoT) scenario, such as Nokia's product WING (Worldwide IoT Network Grid) [50], where the company offers "a platform that is intended to support enterprises in managing connectivity across a number of networks"[51] aimed to be used alongside other products that require connectivity between cellular and non-cellular networks, including "satellite and low power wide area networks"[52].

[49] 'Worldwide IoT Network Grid (WING) | Nokia' (Nokia, 2020) <https://www.nokia.com/networks/services/wing/> accessed 4 March 2020.
[50] Ibid.
[51] Ali Longwell, 'Nokia Dives Into New Market Verticals With WING IoT Platform - Sdxcentral' (2019) <https://www.sdxcentral.com/articles/news/nokia-dives-into-new-market-verticals-with-wing-iot-platform/2019/02/> accessed 4 March 2020.
[52] Ibid.

IaaS is employed in a manner to be fully provisioned and managed over the Internet, by helping users to devoting resources to where it is absolutely essential and avoiding the complexity of purchase and management of their respective physical servers, furthermore, in this model the user only has to pay for the services they use, so if an operation is not as complex the Operator will pay proportional fees for the used services.

Depending on the size and types of operations an Operator may execute the presented cloud-based services through different solutions formats, either individually, or combined to support DaaS.

In some cases a company or person that intends to use drones to execute some form of action may find extensive financial challenges and legal requirements, meaning that relying on an already established service that meets all of the regulatory specifications will be more advantageous than buying and insuring its own UAS, or it may be that one single person simply isn't able to achieve the challenges and complexity of a bigger operation without external support. In those cases, hiring a DaaS Provider will be their best option. The same way SaaS offers the possibility of a customer simply uploading data to have it processed, a customer that needs a topographic analysis of a certain area, can potentially input coordinates on a DaaS platform and receive the results, or a customer can hire DaaS for underground exploration in mining operations, where the DaaS Provider can conduct all of the data-collection operations for an extended period of time, without any processing and avoiding person's life-risk, by exclusively providing the infrastructure and network services to the customer.

Finally, DaaS as an end-product will be the assemble of all of the above contractual formats packed and tailored to the end-customer, where an Operator will be offering its services to be hired and delivered online, under a single B2C contract with varying jurisdictions[53], and its own liabilities clauses.

Again, DaaS is not limited to one model; it is the combination of available online solutions that can potentially be used to promote the development of the business and, consequently, the industry. Clearly the Operators will need to have a basic infrastructure and invest into the concretisation of the actual business, but once they settle on a strategy it will be possible to evaluate what are the essential

[53] The competent jurisdiction can be defined by a number of different factors, such as, where the service provider has established its main place of business, where the operations take place, and choice of jurisdiction between the parties in the contract.

tools required and what are the costs that can be saved in order to deliver solutions to customers and achieve growth.

Although, overall, the DaaS model will probably be an efficient way of applying and promoting the development of drones (mostly for the contractual characteristics of cloud-based services) the framework implemented by the EU [54] is limited to operational and manufacturing regulatory requirements, it assigns liabilities and responsibilities to Operators, remote pilots and manufacturers, without addressing provisions that establish liability regimes and jurisdictional competences for litigation.

As a consequence, independently of what industry the final product of DaaS is offered or the complexity of the operations, the legal obligations of liability will be subject to the combination of air and contract law, which fall under domestic interpretation of civil and international law. In order to successfully execute the principles and further promote the development of DaaS, the drone's industry requires the creation of a clear and harmonised liability framework from the EU, not only regarding operational liabilities but also those of a contractual nature within this modern "as-a-service" frame. After all, there are several topics where liability coverage incurs in a contract, such as "breach of contract, negligence, misrepresentation, infringement of intellectual property rights, breach of statutory duty, regulatory offences and defamation"[55]. For that purpose, this thesis briefly explains what the "Cloud-Services"[56] model means and how DaaS fits in this concept, as a way of enlightening the reader and preparing to introduce the relevance of operations requirements and the reflection on liability assignment.

When exploring DaaS solutions the focus is not only on how one individual can hire a company to deliver a package at their door, but rather how can an Operator create a sustainable and profitable business between the services it offers to consumers and the suppliers that provide the necessary tools for the execution of such services.

[54] Through Regulations (EU) 2019/945 and 2019/947.
[55] McDowell Purcell, 'Commercial Contract Issues: Limiting Your Liability' (Fieldfisher, 2016) <https://www.fieldfisher.com/en-ie/locations/ireland/ireland-blog/commercial-contract-issues-limiting-liability> accessed 28 March 2020.
[56] Tony Hou, 'IaaS Vs PaaS Vs SaaS: What You Need To Know + Examples (2018)' (The BigCommerce Blog) <https://www.bigcommerce.com/blog/saas-vs-paas-vs-iaas/#the-three-types-of-cloud-computing-service-models-explained> accessed 22 November 2019.

Any new business has to extensively evaluate the operational costs and resources allocation in order to succeed, considering the recently implemented Regulations [57] have stipulated the legal requirements for the operations, therefore, the next chapter will introduce the regulatory scenario that will serve as base for DaaS.

[57] Through the combination of Implemented Regulation (EU) 2019/947 of the European Commission of 24 May 2019 on the rules and procedures for the operation of unmanned aircraft; and Delegated Regulation (EU) 2019/945 of the European Commission of 12 March 2019 on Unmanned Aircraft Systems and on third-country Operators of Unmanned Aircraft Systems.

2. REGULATORY LAW

This chapter intends to lay out the regulatory sources of drones, which, throughout the years has been identified by many different terms that vary according to the application of the technology, such as RPAs, UAVs (Unmanned Aerial Vehicles), UASs, and more. With the objective of setting a legitimate framework for the regulation of drones, the EU implemented two regulations that combined establish the harmonisation of termination and provisional requirements for operations of Unmanned Aircraft Systems in the Single Market.

In light of the implementations, the author utilises a linear approach, staring at the international treaties leading to the recognition of drones as aircrafts, followed by the EU actions, including the joint effort of academia, the drones' industry actors and the regulatory bodies, to finally layout the harmonised rules that reign over the operations and consequently reflect on the liability assignment in both operations and commercial contracts.

2.1.INTERNATIONAL LAW

In order to enable the understanding of what are the legal implications for commercial UASs within the civil market, it is necessary to establish the origins of the international regulatory harmonisation. That said, whenever studying modern aviation regulatory developments it is fundamental to refer and recognise the influence of the Convention on International Civil Aviation from 1944 (also known as the Chicago Convention[58]), which established the core principles to permit international transport by air and, as consequence, defined the international rules for commercial aviation, as well as the creation of the responsible international regulatory body, known as the International Civil Aviation Organization (ICAO) [59], which intends to organise and support the intensive international operations supporting the fledging global air transport network requirements. [60] Simply put, the Chicago Convention defines the fundamental principles for international commercial aviation, and since the national legislation has to be in compliance with its terms, it is logical to assume that it bears a respective role for the 193 States' national aviation regulations.[61]

[58] Convention on International Civil Aviation (adopted 7 December 1944, entered into force 4 April 1947) 15 UNTS 295 (Chicago Convention).
[59] 'The History of ICAO and the Chicago Convention' (Icao.int, 2011) <https://www.icao.int/about-icao/History/Pages/default.aspx> accessed 15 November 2019.
[60] Ibid.
[61] Convention on International Civil Aviation (adopted 7 December 1944, entered into force 4 April 1947) 15 UNTS 295 (Chicago Convention). <https://www.icao.int/secretariat/legal/List%20of%20Parties/Chicago_EN.pdf> accessed 15 November 2019.

According to the ICAO, the Chicago Convention was initially negotiated by 54 countries and has now been ratified by 193 nations. In essence the Chicago Convention is the pillar for all commercial aviation, by providing harmonised standards, it allows States to create and regulate compatible domestic legislation.[62]

Even though UAS can be used for international transportation, and in fact there are several companies working towards that goal, for the purpose of this thesis, the focus is on services and not transportation. For that reason, even though the international standardisation perspective is required for certain areas, such as manufacturing and trade, the role of the UAS as a service has a more immediate impact in the domestic jurisdiction environment.

According to Masutti and Filippo,[63] the first recorded promulgated rules on civil use of drones was carried out by the Danish Civil Aviation Authority (CAA)[64] in 1986, followed by a few other States at the beginning of the twenty-first century. The concept of using drones as a commercial option from the perspective of regulatory flight control is directly linked to the national airspace management and surveillance, while the international aspect follows the notion that in order for companies to manufacture, carry and develop their products there needs to be a clear standard set of rules that enable them to be compliant independently of what market they intend to target.

Even though the Danish government had already recognised, and therefore regulated, the use of drones, neither the international community nor the EU had achieved a consensus. Generally speaking, the first step of the creation of new aviation rules is through States reaching an international agreement, followed by domestic regulatory implementation. In this case, the goal was to establish if drones were in fact subjected to the Chicago Convention, since such identification would enable the appropriate legal framing regulatory purposes, without the necessity for creation of a new system.

It is completely understandable to question where the Danish government found a legitimate provision to base their legislative efforts for the establishment of a UAS regulatory framework. As a matter of fact, the foundation was already available through a series of pre-established conventions

[62] The History of ICAO and the Chicago Convention' (Icao.int, 2011) <https://www.icao.int/about-icao/History/Pages/default.aspx> accessed 15 November 2019.
[62] Ibid.
[63] Anna Masutti and Filippo Tomasello, International Regulation Of Non-Military Drones (1st edition, Edward Elgar Publishing Limited 2018), 23-24.
[64] Denmark Civil Aviation Administration, 'Regulations on unmanned aircraft not weighing more than 25 kg', BL 9-4, Edition 1, Copenhagen, 1986.

and protocols; the Aeronautical Commission of the Peace Conference[65], using groundwork provided by the 1910 Paris Diplomatic Conference on aviation[66], established a Convention Relating to the Regulation o Aerial Navigation, which was signed by 27 Sates on 13 October 1919[67]. The Convention consisted of 43 articles and addressed all technical, operational and organisational aspects of civil aviation, as well as it foresaw the creation of the International Commission for Air Navigation (ICAN, to be replaced by the ICAO),[68] under the direction of the League of Nations, with the purpose of monitoring the developments in civil aviation and to propose measures for States to keep abreast of developments.[69]

Tomasello[70] concluded that the Paris Convention of 1919[71] mostly "enshrined the principles of a certificate of airworthiness to the individual aircraft and of a pilot license in its Articles 11 and 12"[72]. That said, the issue of unmanned aircrafts had not been considered under the Convention, but subsequent technical progress and continuous international tensions led ICAN to introduce the principle of "special authorization"[73] in 1929 in the Paris Protocol, amending the Paris Convention of 1919, where the provision of Article 15 acknowledge the existence and established the gateway for pilotless aircrafts regulation.

According to a 2015 study presented by the Secretariat of ICAO, "the Protocol relating to amendments to Articles 3,5,7,15,34,37,40,41 and 42 and to the final clauses of the Convention Relating to the Regulation of Air Navigation of October 13, 1919, done at Paris, June 15, 1929, modified Article 15, in pertinent part, as follows: No aircraft of a contracting State capable of being flown without a pilot shall, except by special authorization, fly without a pilot over the territory of another contracting State" [74].

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[65] *Conference de la paix, 1919-1920, Recueil des actes de la confèrence, Partie VII, Pr6paration et signature des traitès et conventions divers, Procès-verbauxet textes, A-Conventions gènèrales entre alliès, 1) Commission de I'aèronautique. Paris, Imprimerie nationale,* 1933.
[66] *Conference Internationale de Navigation Aerienne.* Paris, 8 May to 28 June 1910. *Proces-verbaux des eances et annexes* (1910)
[67] Convention relating to the Regulation of Aerial Navigation (adopted 13 October 1919, entered into force 29 March 1922) 11 LNTS 173 (Paris Convention of 1919).
[68] The ICAN is also known as CINA, Commission Internationale de Navigation Ariénne).
[69] Anna Masutti and Filippo Tomasello, International Regulation Of Non-Military Drones (1st edition, Edward Elgar Publishing Limited 2018), 51.
[70] Paris Convention of 1919.
[71] Ibid.
[72] Anna Masutti and Filippo Tomasello, International Regulation Of Non-Military Drones (1st edition, Edward Elgar Publishing Limited 2018), 52.
[73] Paris Convention of 1919, Articles 15 and 36.
[74] Study Of Legal Issues Relating To Remotely Piloted Aircraft, ICAO Legal Committee, 36th Session, Working Paper, Agenda Item 2, at 4, ICAO Doc LC/36-WP/2-4 (2015) 3.

The term "special authorization" was reutilized in Article 8 - Pilotless aircraft, of the Chicago Convention, and later imported by the ICAO, from the previously amended ICAN Convention, established the following: "No aircraft capable of being flown without a pilot shall be flown without a pilot over the territory of a contracting State without special authorization by that State and in accordance with the terms of such authorization. Each contracting State undertake to ensure that the flight of such aircraft without a pilot in regions open to civil aircraft shall be so controlled as to obviate danger to civil aircraft".

It is possible to assume that even in 1929 it was already clear that RPAs were in fact aircrafts, hence, they were subject to air law and regulation, in addition there was ground for States to legislate, considering there is a provision for regulation of RPAs crossing international borders. Another example to further support that conclusion is presented through ICAO's study,[75] as follow: "The original text of Annex 7 to the Convention on International Civil Aviation, signed at Chicago on 7 December 1944, as amended (Doc 7300) (Chicago Convention), defined "aircraft" as "any machine that can derive support in the atmosphere from the reactions of the air." This definition was adapted from the French language text of the definition of "aircraft" in the 1919 Paris Convention ("*Le mot aéronef désigne tout appareil pouvant se soutenir dans l' atmosphere grâce aux reactions de l' air*")[76]. In 1967, amendments to Annex 7 included a new definition of "aircraft"[77] as "any machine that can derive support in the atmosphere from the reactions of the air other than the reactions of the air against the earth's surface"[78], to exclude hovercraft from its scope. Today, Annex 7 makes it clear that remotely piloted aircraft (RPA) are simply one type of unmanned aircraft,[79] and all unmanned (pilotless) aircraft, whether remotely piloted, fully autonomous, or combinations thereof, are subject to the provisions of Article 8 of the Chicago Convention" [80].

Considering the broad, yet accurate, definition of "aircraft"[81] that includes RPAs and the provision of a "special authorization" [82] for States to regulate international aircrafts flying over national territory, it is becomes clear that both the international community and States are able to rely on the

[75] Study Of Legal Issues Relating To Remotely Piloted Aircraft, ICAO Legal Committee, 36th Session, Working Paper, Agenda Item 2, at 4, ICAO Doc LC/36-WP/2-4 (2015) 3.
[76] Paris Convention of 1919.
[77] Ibid.
[78] Ibid.
[79] Annex 7 to the Convention on International Civil Aviation: Aircraft Nationality and Registration Marks, at 2 (6th ed., 2012) ('Annex 7').
[80] Ibid.
[81] Paris Convention of 1919.
[82] Ibid., Articles 15 and 36.

Chicago Convention as a pillar for their jurisdictional competence to develop respective regulations concerning RPAs and UASs.

2.2.EUROPEAN UNION LAW

The European Commission acknowledged the importance of the development of unmanned aircraft, commonly known as drones, "as a promising new chapter in the history of aerospace"[83], but it also recognises the lack of a clear regulatory framework at EU level, which impedes the creation of a truly European market for drone service aircraft.[84]

In order to address the absence of regulation the European Commission, which became competent for regulating drones following the Aviation Safety Regulation (often referred to as the "Basic Regulation")[85], proposed "under the Aviation Strategy for the Single Market",[86] to create a risk-based framework for all types of drone operations. Said framework aims at ensuring "the safe use of drones in civil airspace" by creating "legal certainty for the industry"[87]. The context of the framework talks into account concerns related to "privacy and data protection, security, liability and insurance or environment"[88].

The Commission is working through a joint effort with the European Aviation Safety Agency (EASA) to ensure that future rules for unmanned aircrafts are "proportionate to the risk involved and to ensure that new developments are not hampered by unnecessarily heavy and costly rules and procedures". Furthermore, "the Commission will also seek to rely on industry standards as far as possible"[89].

The concept of a governmental body represented by a regulatory agency actively seeking industry contribution to define and assert a new framework may be considered another fundamental pillar to the establishment of the drone industry. In comparison to that approach, Borenstein and Rose affirm that "Government policy rather than market forces shaped the development and operation of

[83] 'Unmanned Aircraft (Drones) - Mobility and Transport' (Mobility and Transport - European Commission, 2019) <https://ec.europa.eu/transport/modes/air/uas_en> accessed 29 November 2019.
[84] Ibid.
[85] Tania Lațici, 'Civil And Military Drones - Navigating A Disruptive And Dynamic Technological Ecosystem' (EPRS Briefing 2019) 5.
[86] 'What Do We Want To Achieve? - Mobility and Transport' (Mobility and Transport - European Commission, 2019) <https://ec.europa.eu/transport/modes/air/aviation-strategy_en> accessed 29 November 2019.
[87] Ibid.
[88] 'Unmanned Aircraft (Drones) - Mobility and Transport' (Mobility and Transport - European Commission, 2019) <https://ec.europa.eu/transport/modes/air/uas_en> accessed 29 November 2019.
[89] Ibid.

scheduled passenger air service in almost all markets for the first six decades of the airline industry's history"[90].

Furthermore, international contributions have enforced the regulatory framework, such as "the transition to a more market-based aviation industry that began in the U.S. in themid-1970s. The enactment of the Airline Deregulation Act of 1978 eliminated price and entry regulation of the domestic airline industry and provided for ultimate closure of its regulatory agency, the Civil Aeronautics Board (CAB)"[91]. Additionally, the authors highlighted that already in 2003 "notable exceptions are within the European Union (EU), where formal restraints on commercial aviation have been liberalized considerably over the past 15 years with the creation of an open intra-EU aviation market, and a limited number of "open skies" agreements"[92].

Overregulation strains the private market operations of companies by hindering the competitiveness within the industry, and other times simply by setting unattainable compliance obligations. As previously mentioned, the aviation agencies recognised the value in consulting and sometimes even delegating some responsibilities, such as the identification of risks and proposal of solutions to the actors of the industry, while still holding the power to make the final decision. Through the welcoming of the opinions and concerns presented by those subjected to the regulations, the regulatory bodies and governments have achieved an unprecedented collaboration through the joint effort of public and private parties to reach what is known as "Deregulation"[93].

In 2015, aware of the commercial uprising of drones, as well as of recent general developments in the aviation industry that had to be addressed, the Commission proposed the "2015 EU Aviation Strategy"[94], which consisted of the following chapters: "An ambitious EU external aviation policy; Tackling limits to growth in the air and on the ground; Maintaining high EU standards; and Innovation, investments and digital technologies"[95].

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[90] Severin Borenstein and Nancy Lee Rose, 'How Airline Markets Work...Or Do They? Regulatory Reform In The Airline Industry' [2007] National Bureau of Economic Research, Inc. <https://ideas.repec.org/p/nbr/nberwo/13452.html> accessed 29 November 2019.
[91] Ibid.
[92] Ibid.
[93] Ibid., 10.
[94] Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions an Aviation Strategy for Europe. European Commission. Brussels, 7 December 2015.
[95] 'What Do We Want To Achieve? - Mobility and Transport' (Mobility and Transport - European Commission, 2019) <https://ec.europa.eu/transport/modes/air/aviation-strategy_en> accessed 29 November 2019.

The drones' topic was included under the "Innovation, investments and digital technologies"[96] chapter, and was further supported by the Riga Declaration on Remotely Piloted Aircraft (drones) titled "Framing the Future of Aviation"[97]. Following the precedent set by "Deregulation"[98], the Riga Declaration was formulated and confirmed in an effort by the "Latvian Presidency of the Council of the European Union, European Commission representatives, Directors General of Civil Aviation of the EU Member States (MS), data protection authorities and leaders of manufacturing industry and service providers building on the orientations given in the EC Communication on opening the Remotely Piloted Aircraft Systems (RPAS) market"[99].

Ultimately, the aviation community agreed on the need for European regulators to ensure that all conditions for the safe and sustainable emergence of drone's services are met, concomitantly helping the industry to thrive and adequately deal with citizen's concern.

2.2.1. RIGA DECLARATION ON REMOTELY PILOTED AIRCRAFT (DRONES)

The Riga Declaration, formally presented the concerns that the aviation community faced with the emergence of drones in 5 different topics that can also be considered the principles of the creation of the EU regulation:

2.2.1.1. PROPORTIONALITY PRINCIPLE

- *"Drones need to be treated as new types of aircraft with proportionate rules based on the risk of each operation."*

According to the Riga Declaration: "The provision of drone services must not be less safe than is accepted from civil aviation in general. The incremental integration of drones in the aviation system must not reduce the level of safety presently achieved in civil aviation. Although no one is on board the drone, people in other aircraft or on the ground could get hurt in case of an accident or an unscheduled landing. The way safety is regulated must be proportional to the operational risk

[96] Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions an Aviation Strategy for Europe. European Commission. Brussels, 7 December 2015.
[97] Riga Declaration on Remotely Piloted Aircraft (drones) 'Framing the Future of Aviation', Latvian presidency of the Council of the European Union, Riga (2015), 1.
[98] Severin Borenstein and Nancy Lee Rose, 'How Airline Markets Work...Or Do They? Regulatory Reform In The Airline Industry' [2007] National Bureau of Economic Research, Inc. <https://ideas.repec.org/p/nbr/nberwo/13452.html> accessed 29 November 2019. 10.
[99] Ibid.

involved. Rules should be simple, and performance based, to allow a small start-up company or individuals to start low-risk, low-altitude operations under minimal rules and to develop, with light-touch risk-based regulation, similar to the modern product safety regulations applied in other sectors. Higher risk operations would be gradually subject to more stringent regulations or operational limitations. At the other end of the spectrum, where the operational risk is highest, such as with large drones operating alongside manned aircraft, the regulation will need to be quite similar to that applying to manned aviation, with strict standards on the design, manufacturing, maintenance and operation of drones, as well as on the training of drone pilots and maintenance personnel"[100].

In conclusion, this principle supports the notion of a proportional response where the rules should be "simple and performance based" rather than extensively restrictive and counter efficient, supporting the concept of "Deregulation"[101]. The goal is to promote the development of the industry through regularization and not to impose rules that will hinder the EU competitiveness against the international community.

While the introduction of a new kind aircraft to the European Single Sky does present certain challenges and risks, the overregulation of the activity by the EU can directly hinder the competitiveness of the EU and international companies that intend to operate in this territory. In comparison to other States, such as the USA, where the regulation of aerial activities falls under one single and autonomous jurisdiction, the EU belongs to a supranational organisation. It is easy to conclude that complying with the rules of one single State can be more profitable than being forced to comply with the divergent rules of the Member States. In one hand the companies will have a choice between vast territory with one rule, and on the hand a collective of smaller territories with conflicting provisions.

In order to promote the competitiveness, such contrast can be remedied by setting minimum regulatory rules that address the safe operations in the EU. On top of that, the it is imperative for the EU legislators to consider the fact that drones are cheaper, smaller and unmanned aircrafts, that cannot be framed under the same laws of commercially manned aircrafts. The risks and challenges are very different from the later, and so such fact must be taken under consideration to satisfy the private sector and promote international competitiveness for the companies that will establish operations in the EU.

[100] Riga Declaration on Remotely Piloted Aircraft (drones) 'Framing the Future of Aviation', Latvian presidency of the Council of the European Union, Riga (2015), 2.
[101] Severin Borenstein and Nancy Lee Rose, 'How Airline Markets Work...Or Do They? Regulatory Reform In The Airline Industry' [2007] National Bureau of Economic Research, Inc. <https://ideas.repec.org/p/nbr/nberwo/13452.html> accessed 29 November 2019. 10.

2.2.1.2. HARMONISED REGULARISATION PRINCIPLE

- *"EU rules for the safe provision of drone services need to be developed now."*

The participants have agreed that: "Safety rules, including on remote pilot and Operator qualifications, should be developed at the European level by the European Aviation Safety Agency, building on the experience developed in the EU MS. The essential requirements should be harmonized at the global level to the maximum extent possible, and full use should be made of the established cooperation in the Joint Authorities for Rulemaking on Unmanned Systems (JARUS) and at ICAO and should be completed by international industry standard setting bodies. …This basic regulatory framework should be put in place without delay, in order to help the private sector to take well-informed investment decisions, and to provide a basic set of rules for the many Operators who are increasingly eager to begin providing services. …the Agency will use the results of the consultation to propose a position on these matters. The proposal… should contain the necessary new provisions and essential requirements for the progressive risk-based regulation of drones, based on the Agency's recommendations"[102].

It is worth noting that States outside of the EU have the same legitimacy to regulate drones in their national territory, as well as some EU MS, but that the effort to harmonize had not been initialized until much later. When the attendants of the Riga Declaration state that it needs to happen immediately, it is not simple because they seek to develop, but also to avoid falling behind other economical potencies, such as the USA and China.

As previously stated, the harmonization is necessary to allow the competitiveness between the EU and other States. Even though so far MSs have been regulating their own territories, in order to achieve the foreseen potential of drones on a global scale, the EU needs to serve as an expansion platform for the developers and investors. Through the harmonization of the regulations, it allows for companies to operate under a single legal frame, allowing the private sector acting in the EU to grow in a similar rhythm than in competing territories (such as the USA and China).

2.2.1.3. STANDARDISATION PRINCIPLE

[102] Riga Declaration on Remotely Piloted Aircraft (drones) 'Framing the Future of Aviation', Latvian presidency of the Council of the European Union, Riga (2015) 2-3.

- *"Technologies and standards need to be developed for the full integration of drones in the European airspace."*

The idea of standardisation is classed as: "The success of drone activities and safety regulations also depends on the financial effort to develop and validate key missing technologies and the ensuing required standards. Both industry and public authorities stressed the need for adequate investment in the technologies that are required to integrate drones into the aviation system – the Single European Sky Air Traffic Management Research (SESAR) programme. Clean Sky and other initiatives should complete the SESAR investments. That would create spin-off benefits for traditional aviation and so frame the future of flying"[103].

According to the SESAR, "The SESAR Joint Undertaking (SJU) was established under Council Regulation (EC) 219/2007 of 27 February 2007 (as modified by Council Regulation (EC) 1361 / 2008 (SJU Regulation) and last amended by the Council Regulation (EU) 721/2014)"[104]. The project was launched as the technological principle of the Single European Sky (SES), and its role is to define, develop and deploy what is needed to increase air traffic management (ATM) performance and build Europe's intelligent air transport system. In addition, established in 2007 as a public-private partnership, the SJU is responsible for the modernisation of the European ATM system by coordinating and concentrating all ATM relevant research and innovation efforts in the EU.[105]

Otherwise speaking, the community demands that on top of the creation the regulatory demands, a concrete effort towards implementation is primordial. It can be concluded that it is not enough to state what can and can't be done, but also how the community will execute the practical management of the industrial standards. In response to the industry's claims, the standardization efforts by the EU include, but are not limited to, the Horizon 2020 project committing €44 million worth of grants through SESAR for the safe integration of drones in the airspace.[106]

2.2.1.4. POPULARISATION PRINCIPLE

- *"Public acceptance is key to the growth of drone service."*

[103] Ibid., 3.
[104] 'SESAR Joint Undertaking | History' (Sesarju.eu) <https://www.sesarju.eu/discover-sesar/history> accessed 29 November 2019.
[105] Ibid.
[106] Tania Lațici, 'Civil And Military Drones - Navigating A Disruptive And Dynamic Technological Ecosystem' (EPRS Briefing 2019), 11.

In-between many concerns, the participants also concluded that, "the respect of citizens' fundamental rights, such as the right to privacy and the protection of personal data, must be guaranteed"[107].

As it is known, "many drone services involve data-gathering such as filming, etc. …Rules need to clarify what is acceptable and what is not, and they require to be properly enforced. Drones may cause nuisances and negative externalities, such as noise. These nuisances need to be addressed, possibly at the local level, to maintain public acceptance. Drones also pose potential security risks. The design of drones can and should take into account those risks by using methods such as cyber-defence or defencing. However, the malicious use of drones cannot be entirely prevented by design or operational restrictions. It is the task of the national police and justice systems to address those risks"[108].

Public acceptance is indeed a requirement for any implementation that affects the civil population, which in essence means the popularization of the technology by the citizens who are affected by it. With that said, the most relevant addition this principle presents is the introduction to recognition of national jurisdiction over certain aspects of the harmonisation of the drones' regulations.

2.2.1.5. ACCOUNTABILITY PRINCIPLE

- "*The Operator of a drone is responsible for its use.*"

The Accountability Principle is perhaps the most important for this thesis, as it contains both the conclusion that motivated this thesis and the original text that inspired the provisions of liability for drones' Operators.

According to the Declaration, drone accidents are inevitable, and therefore must be addressed through regularisation. The Declaration reads:

- Regarding Accidents Liability: "Drone accidents will happen. Member States should clarify the applicable insurance and third-party liability regime and monitor the compensation mechanisms for potential victims. …Systematic and coherent incident reporting will improve

[107] Riga Declaration on Remotely Piloted Aircraft (drones) 'Framing the Future of Aviation', Latvian presidency of the Council of the European Union, Riga (2015), 4.
[108] Ibid.

safety and will be instrumental for insurance companies in their risk analysis on which third-party liability insurance premiums are based"[109].

- Regarding Accountability: "When drone service is delivered in prohibited airspace, in an unsafe manner, or for illegal purposes, the authorities should be able to act and hold the Operator accountable. Where lacking, this will need to be clarified in national law. Moreover, in order to enforce responsibility, it will be necessary for drones to have at all times an identifiable owner or Operator"[110].

Finally, the Riga Declaration triggered the joint effort towards what is considered the next milestone to for the drones' industry, the creation and implementation of the Regulations (EU) 2019/945 and 2019/947.[111]

2.2.2. REGULATIONS (EU) 2019/945 AND (EU) 2019/947

Because of the popularisation of the technology, drones use, and the lack of an established framework to deal and address the growing concerns regarding the disruptive and dynamic technological ecosystem rising from the continuous use of RPAs, some measures were required. To satisfy the need, the EU set a strategy that rethinks the business models, existing laws, safety and security standards, the future of transportation, and modern warfare related concerns. Initially, the EU Regulation 216/2008 addressed the common rules in the field of civil aviation, covering Unmanned Aerial Vehicles (UAVs) with a maximum take of mass (MTOM) of more than 150 kg, and established that UAVs below this threshold were to be regulated by the Member States, which led to divergent national rules and consequent fragmentation of the EU internal market legislation.[112]

As previously presented, any regulatory effort that intend to frame drones will be directly influenced by aviation rules. That said, even though drones are aircrafts they are not airplanes, therefore, they are neither built as nor behave as airplanes within the aviation framework, meaning drones are an entirely new technology, with specific proprieties and technicalities.

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[109] Riga Declaration on Remotely Piloted Aircraft (drones) 'Framing the Future of Aviation', Latvian presidency of the Council of the European Union, Riga (2015), 5.
[110] Ibid., 4.
[111] Implemented Regulation (EU) 2019/947 of the European Commission of 24 May 2019 on the rules and procedures for the operation of unmanned aircraft; and Delegated Regulation (EU) 2019/945 of the European Commission of 12 March 2019 on Unmanned Aircraft Systems and on third-country Operators of Unmanned Aircraft Systems.
[112] Steven De Schrijver, 'Commercial Use Of Drones: Commercial Drones Facing Legal Turbulence: Towards A New Legal Framework In The EU' (2019) 16 US-China Law Review, 338.

In order to further develop the understanding of the EU regulatory framework, the first step is to address the vocabulary of drones. The justification for such approach becomes very clear by simply reading the title of Regulation (EU) 2019/947 (also known as UAS Regulation),[113] which specifies that the Regulation sets the rules and procedures for the operation of "unmanned aircrafts"[114], rather than the simplified term "drones"[115].

So, what is the difference between a drone and an unmanned aircraft? Lațici, succinctly explains that, "unmanned aircraft or unmanned aerial vehicles (UAV), remotely piloted aircraft systems (RPAS) and Unmanned Aircraft Systems (UAS) are all different ways of referring to what are most commonly known as drones. While broadly referring to the same concept, the various terms actually represent different pieces of the puzzle. For instance, while any aircraft flown without a pilot present on board is an unmanned aircraft, an RPAs also includes an associated remote pilot station and command and control functions"[116].

Another term that can cause confusion is "operation"[117]. For the sake of clarity, UAS Operator or DaaS Operator "means any legal or natural person operating or intending to operate one or more UAS"[118]; Economic Operators "means the manufacturer, the authorised representative of the manufacturer, the importer, and the distributor of the UAS"[119]; and "operations" are understood to be the performance of UAS activities, such as conducting unamend aircraft flights for both private or commercial activities.

Based on the previously presented information, it is now possible to introduce the framework set by the UAS Regulation, which establishes that unmanned aircrafts, irrespective of their masses, are now allowed to operate within the same Single Sky airspace alongside manned aircrafts (such as commercial airlines operations and privately operated aircrafts, including both airplanes and

[113] Regulation (EU) 2019/947 of the European Commission of 24 May 2019 on the rules and procedures for the operation of unmanned aircraft.
[114] UAS Regulation, Article 1.
[115] 'Drone, UAV, UAS, RPA or RPAS'. 'The terms Unmanned Aircraft (UA) or Remotely Piloted Aircraft (RPA) are used to describe the aircraft itself, whereas the term Unmanned Aerial System (UAS) is generally used to describe the entire operating equipment including the aircraft, the control station from where the aircraft is operated and the wireless data link.' (AltiGator Drone & UAV Technologies, 2019) <https://altigator.com/drone-uav-uas-rpa-or-rpas/> accessed
[116] Tania Lațici, 'Civil And Military Drones - Navigating A Disruptive And Dynamic Technological Ecosystem' (EPRS Briefing 2019), 3.
[117] Regulation (EU) 2019/945 of the European Commission of 12 March 2019 on Unmanned Aircraft Systems and on third-country Operators of Unmanned Aircraft Systems, Article 3 (4).
[118] Ibid.
[119] Ibid., Article 3 (17).

helicopters).[120] The outcome of these singular decisions was the first step towards harmonisation of UAS legislation within the EU, as by deciding where an UAS is not allowed to operate the EU started to draft the lines for operational conducts.[121]

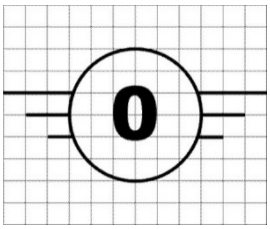
This chapter explores two Regulations that complement each other. Firstly, Regulation (EU) 2019/947, or UAS Regulation, sets "detailed provisions for the operation of Unmanned Aircraft Systems as well as for personnel, including remote pilots and organisations involved in those operations in the EU"[122]. Secondly, Regulation (EU) 2019/945 establishes the requirements for the UAS' designs, manufacturing and remote add-ons; it establishes the rules for UAS identification add-ons' making, intended for use in the "open" category within the free movement market in the Union; and finally, it sets the rules pursuant to third-country UAS Operators when conducting operations within the European sky airspace. Overall the UAS regulation set the operational certifications and Regulation (EU) 2019/945 defines the aircrafts classifications, by combining both it is possible to understand the risk progression, accordingly.

2.2.2.1.UAS CLASSES[123]

Given the fact that UASs are a new technology, it is almost impossible to start discussing operational procedures and liabilities without the introduction of the engineering parameters that serve as base for the classification and management of risk for operations. With that said, in order to navigate through the UAS regulation, it's imperative to have a least a basic knowledge of the aircrafts classes set by Regulation 2019/945 (aimed at defining hardware specifications), that collectively layout the "basis of operational limitations, requirements for the remote pilot and technical requirements for UAS"[124].

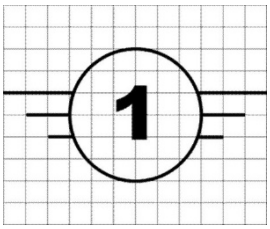
Hence, these are the five classes' identification labels and a brief description with the highlights of their requirements, respectively: C0; C1; C2; C3; and C4:

[120] UAS Regulation, Recital (1).
[121] UAS Regulation, Recital (2).
[122] UAS Regulation, Article 1.
[123] Regulation (EU) 2019/945, Article 16.
[124] Ibid.



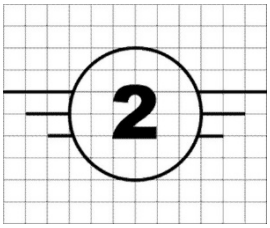
- C0[125]

  UAS shall "have a maximum take-off mass of the aircraft (MTOM) of less than 250g, including payload"[126]; "maximum speed in level flight of 19m/s" [127]; "maximum attainable height above take-off point limited to 120m"[128]; and more.



- C1[129]

  UAS shall "have an MTOM of less than 900g, including payload, or alternatively, be built in a way that ensures the maximum energy transmission on impact with a human head to be less than 80J"[130]; "maximum speed of 19m/s"[131]; "maximum attainable height above take-off point limited to 120m, or alternatively, be equipped with a system that limits the height above the surface or above the take-off point to 120m (geo-awareness system)) or to a value selectable by the remote pilot"[132]; and more.

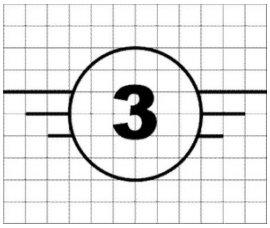


- C2[133]

  UAS shall "have an MTOM of less than 4kg, including payload"[134]; "maximum attainable height above take-off point limited to 120m, or alternatively, be equipped with a system that limits the height

[125] Ibid., Annex, Part 1.
[126] Ibid., Annex, Part 1, (1).
[127] Ibid., Annex, Part 1, (2).
[128] Ibid., Annex, Part 1, (3).
[129] Ibid., Part 2.
[130] Ibid., Part 2, (1).
[131] Ibid., (2)
[132] Ibid., (3)
[133] Regulation (EU) 2019/945, Annex, Part 3.
[134] Ibid., (1)

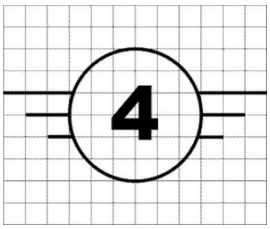
above the surface or above the take-off point to 120m (geo-awareness system) or to a value selectable by the remote pilot"[135]; "be safely controllable with regards to stability, manoeuvrability and data link performance, by a remote pilot with adequate competency as defined in UAS Regulation and following the manufacturer's instructions, as necessary under all anticipated operating conditions including following the failure of one or, if appropriate, more systems; in the case of a tethered UA, have a tensile length of the tether that is less than 50m and a mechanical strength that is no less than: a) for heavier-than-air aircraft, 10 times the weight of the aerodyne at maximum mass; b) for lighter-than-air aircraft, 4 times the force exerted by the combination of the maximum static thrust and the aerodynamic force of the maximum allowed wind speed in flight"[136]; and more.



- C3[137]

  UAS shall "have an MTOM of less than 25kg, including payload, and have a maximum characteristic dimension of less than 3m"[138]; "maximum attainable height above take-off point limited to 120m, or alternatively, be equipped with a system that limits the height above the surface or above the take-off point to 120m (geo-awareness system) or to a value selectable by the remote pilot"[139]; "be safely controllable with regards to stability, manoeuvrability and data link performance, by a remote pilot with adequate competency as defined in UAS Regulation and following the manufacturer's instructions, as necessary under all anticipated operating conditions including following the failure of one or, if appropriate, more systems"[140]; "in the case of a tethered UA, have a tensile length of the tether that is less than 50 m and a mechanical strength that is no less than: a) for heavier-than-air aircraft, 10 times the weight of the aerodyne at maximum mass; b) for lighter-than-air aircraft, 4 times the force exerted by the combination of the maximum static thrust and the aerodynamic force of the maximum allowed wind speed in flight"[141]; and more.

[135] Ibid., (2).
[136] Ibid., (5), (a) and (b)
[137] Ibid., Part 4.
[138] Ibid., (1).
[139] Ibid., (2).
[140] Ibid., (3)
[141] Ibid., (4)



- C4[142]

  UAS shall "have an MTOM of less than 25kg, including payload"[143]; "be safely controllable and manoeuvrable by a remote pilot following the manufacturer's instructions, as necessary under all anticipated operating conditions including following the failure of one or, if appropriate, more systems" [144]; "not be capable of automatic control modes except for flight stabilisation assistance with no direct effect on the trajectory and lost link assistance provided that a pre-determined fixed position of the flight controls in case of lost link is available"[145]; and more.

2.2.2.2.UAS CATEGORIES

In reference to the Riga Declaration, the UAS Regulation further reassures the Proportionality Principle[146] and uses it to create a classification system that divides UAS Operations in 3 different categories, [147] setting a framework intended to regulate both commercial and non-commercial activities of UASs, which, according to Finger et al, is equated to the risk posed by the operation to persons and properties, using the maximum take-off mass of the aircraft (MTOM) as a division method.[148] They are: Open;[149] Specific;[150] and Certified.[151]

2.2.2.2.1. OPEN CATEGORY[152]

[142] Regulation (EU) 2019/945, Annex, Part 5.
[143] Ibid., (1)
[144] Ibid., (2)
[145] Regulation (EU) 2019/945, Annex, Part 5, (3).
[146] UAS Regulation, Recital (5) and (7).
[147] UAS Regulation, Article 3.
[148] Matthias Finger, Nadia Bert and David Kupfer, Regulating Drones - Creating European Regulation That Is Smart And Proportionate (European University Institute 2015), 2.
[149] UAS Regulation, Recital (8) and Article 4.
[150] UAS Regulation, Recital (9) and Article 5.
[151] UAS Regulation, Recital (11) and Article 6.
[152] UAS Regulation, Article 4.

The Open category regulates and foresees "simple low-risk experience-gathering operations"[153] rules and is appropriate for UAS that are not subject to standard aeronautical compliance procedures, but shall be conducted using the classes defined in Article 20 of the Commission Delegated Regulation[154] (EU) 2019/945, [155] and depending on the subcategory can, but is not always mandatory, demand a specific certification from competent authorities.[156]

For the sake of clarity, this category considers UAS to be low risk depending on the MTOM and operation impact that the aircraft poses, setting a limit MTOM of less than 25kg, case in which the authorities must be notified about the operation,[157] as well as the maximum altitude of 120 meters "from the closest point of the surface of earth"[158], Furthermore, "by way of derogation from point (2), unmanned sailplanes with a MTOM, including payload, of less than 10 kg, may be flown at a distance in excess of 120 metres from the closest point of the surface of the earth, provided that the unmanned sailplane is not flown at a height greater than 120 metres above the remote pilot at any time"[159].

The Open category is further divided in 3 subcategories: A1; A2 and A3;[160] which combined with the abovementioned 5 different classes, establish the starting ground layout for all categories on the basis of operational limitation, requirements for the remote pilot and technical requirements for UAS. They address "(i) flights over people (but not crowds) (A1); (ii) flights close to people whereby a safe distance is kept (A2); and (iii) flights far away from people (A3), where different technical requirements are used depending on the activity. Enforcement is done mainly by the police."[161]

- Subcategory A1

  Regulates the following:

[153] Steven De Schrijver, 'Commercial Use Of Drones: Commercial Drones Facing Legal Turbulence: Towards A New Legal Framework In The EU' (2019) 16 US-China Law Review, 342.
[154] UAS Regulation, Article 3 (a).
[155] UAS Regulation, Recital (8), (12) and (15).
[156] UAS Regulation, Recital (15). 'Studies have demonstrated that unmanned aircraft with a take-off mass of 250 g or more would present risks to security and therefore UAS Operators of such unmanned aircraft should be required to register themselves when operating such aircraft in the 'open' category.'
[157] UAS Regulation, Article 4 (1) (b).
[158] UAS Regulation, Article 4 (1) (e) and Annex, Part A, (2).
[159] UAS Regulation, Annex, Part A, (4).
[160] UAS Regulation, Annex, Part A, (1).
[161] Steven De Schrijver, 'Commercial Use Of Drones: Commercial Drones Facing Legal Turbulence: Towards A New Legal Framework In The EU' (2019) 16 US-China Law Review, 342.

- UAS marked as C1 shall not overfly assemblies of people as well as reasonably expect that no "uninvolved person"[162] will be overflown.[163] In other words, the operation will not present a risk to anyone other than the Operator.
- For UAS with "MTOM, including payload, of less than 250g and a maximum operating speed of less than 19 m/s, in the case of a privately built UAS"[164]; is "A1 with maximum MTOM of 250g"[165]; or is marked C0 and respects all the requirements set in "Part 1 of the Annex to Delegated Regulation (EU) 2019/945"[166].
- As well as other requirements to be met relate to remote piloting performance, such as: "air safety; airspace restrictions; aviation regulations; human performance limitations; operational procedures; UAS general knowledge; privacy and data protection; insurance; and security"[167].

o Subcategory A2

Regulates the following:

- The conduction must be "in such a way that the unmanned aircraft does not overfly uninvolved persons and the UAS operation must take place at a safe horizontal distance of at least 30 metres from them"[168].
- The performance shall be "by a remote pilot who is familiar with the user's manual provided by the manufacturer of the UAS and holds a certificate of remote pilot competency issued by the competent authority or by an entity recognised by the competent authority of the Member State of registration of the UAS Operator"[169].
- The performance of aircrafts marked C2, operating "with active and updated direct remote identification and geo-awareness systems"[170]. For the purpose of further enlightenment, C2 requirements are defined in Part 3 of the Annex to Delegated Regulation (EU) 2019/945.[171]

o Subcategory A3

[162] UAS Regulation, Annex, Part A, UAS.OPEN.020 'UAS operations in subcategory A1' (1) and (5) (d).
[163] UAS Regulation, Article 2 (18): ''uninvolved persons' means persons who are not participating in the UAS operation or who are not aware of the instructions and safety precautions given by the UAS Operator.'
[164] UAS Regulation, Annex, Part A, UAS.OPEN.020 'UAS operations in subcategory A1' (2) and (5) (a).
[165] UAS Regulation, Article 20 (a), Annex, Part A, UAS.OPEN.020 'UAS operations in subcategory A1' (2) and (5) (b).
[166] UAS Regulation, Annex, Part A, UAS.OPEN.020 'UAS operations in subcategory A1' (2) and (5) (c).
[167] Ibid., (4).
[168] UAS Regulation, Annex, Part A, UAS.OPEN.030 'UAS operations in subcategory A2' (1).
[169] Ibid., (2).
[170] Ibid., (3).
[171] Regulation (EU) 2019/945 of the European Commission of 12 March 2019 on Unmanned Aircraft Systems and on third-country Operators of Unmanned Aircraft

Regulates the following:

- The conduction must be "in an area where the remote pilot reasonably expects that no uninvolved person will be endangered within the range where the unmanned aircraft is flown during the entire time of the UAS operation"[172]; "at a safe horizontal distance of at least 150 metres from residential, commercial, industrial or recreational areas; by a remote pilot who has completed an online training course and passed an online theoretical knowledge examination as defined in point (4)(b) of UAS Regulation, Annex, Part A, "UAS operations in subcategory A3"[173].
- The performance of "unmanned aircrafts that, have an MTOM, including payload, of less than 25kg, in the case of a privately built UAS, or meets the requirements defined in point (b) of Article 20"[174]; "is marked as class C2 and complies with Part 3 of the Annex to Delegated Regulation (EU) 2019/945" [175]; "is marked as class C3 and complies with Part 4 of the Annex to Delegated Regulation (EU) 2019/945"[176]; "is marked as class C4 and complies with Part 5 of the Annex to Delegated Regulation (EU) 2019/945"[177].[178]

Overall categories A1 and A2 aim at regulating the personal use of UAS, preferably for amateur, non-commercial, very low risk activities. The higher the risks grow; the bigger government and local authority involvement will be. If originally the Operator only expected to fly a small drone at an empty beach for a few shots of its holidays, there will be a very low requirement, Open/A1 category is applied, but if the same beach alternatively has people who are no involved in the operations and, the Operator is from a furthest distant, and the drone is bigger, Open/A2 category is applied.

In general, aviation authorities shouldn't be involved in most use cases involving these categories. Yet, as the Open category is directed at personal use of UAS, it will see a relatively increase in numbers in regards to the following years, meaning that it will be up to local authorities to further regulate the Open category in accordance to the risks that they may pose to the uninvolved persons. For the purposes of DaaS, this category is relevant in the case of subcategory A3, which describes the obligations and responsibilities of Operators and Pilots, and consequently the applicable liabilities of DaaS Providers, which is relevant to the commercialisation of UASs services that can potentially perform under this category.

[172] UAS Regulation, Annex, Part A, UAS.OPEN.040 'UAS operations in subcategory A3' (1).
[173] Ibid., (1) (2) (3).
[174] UAS Regulation, Annex, Part A, UAS.OPEN.040 'UAS operations in subcategory A3', (4).
[175] Ibid., (4), (c).
[176] Ibid., (4), (d).
[177] Ibid., (4), (e).
[178] Ibid., 4.

Examples of the responsibilities of an UAS Operator are:

"**UAS Regulation,**

Annex

Part A

UAS operations in subcategory A3

Responsibilities of the UAS Operator

The UAS Operator shall comply with all of the following:

(1) develop operational procedures adapted to the type of operation and the risk involved;

(2) ensure that all operations effectively use and support the efficient use of radio spectrum in order to avoid harmful interference;

(3) designate a remote pilot for each UAS operation; [179]

(4) ensure that the remote pilots and all other personnel performing a task in support of the operations are familiar with the user's manual provided by the manufacturer of the UAS, and:

(a) have appropriate competency in the subcategory of the intended UAS operations in accordance with points UAS.OPEN.020, UAS.OPEN.030 or UAS.OPEN.040 to perform their tasks or, for personnel other than the remote pilot, have completed an on-the-job-training course developed by the Operator;

(b) are fully familiar with the UAS Operator's procedures;

(c) are provided with the information relevant to the intended UAS operation concerning any geographical zones published by the Member State of operation in accordance with Article 15;

(5) update the information into the geo-awareness system when applicable according to the intended location of operation;

(6) in the case of an operation with an unmanned aircraft of one of the classes defined in Parts 1 to 5 of Delegated Regulation (EU) 2019/945, ensure that the UAS is:

(a) accompanied by the corresponding EU declaration of conformity, including the reference to the appropriate class; and

(b) the related class identification label is affixed to the unmanned aircraft.

(7) Ensure in the case of an UAS operation in subcategory A2 or A3, that all involved persons present in the area of the operation have been informed of the risks and have

[179] UAS Regulation, Article 20 (a), Annex, Part A, UAS.OPEN.040 'UAS operations in subcategory A3' and UAS.OPEN.050 'Responsibilities of the UAS Operator.'

explicitly agreed to participate. 11.6.2019 L 152/62 Official Journal of the European Union EN."[180]

(Edited by writer)

The above provision seems brief and simple, but in fact it represents quite the opposite. Through the employment of seemingly abstract ideas, the legislator appoints the UAS Operator as incumbent for all consequences derived from the operations management and execution, resulting in their direct liability in the event of accidents and faulty performances. Later on, the legislator further unfolds all of the requirements for the authorization of operations, enlightening the maturity and awareness demanded from UAS Operators according to the risk of the operations.

The importance of the Operator's responsibilities is the link to the representation of regulatory liability of a service provider towards a State. Being able to identify such responsibilities is imperative in order to assess the risks assumed in an operation. Regulatory responsibility is a topic that is heavily accounted when ruling over accidents and compensation calculations, as well as it defines the role of both supervision and accountability that is relied upon the Operator.

Such responsibilities cannot be negotiated in a contract, as they are the foundation of the service itself. Instead, these regulatory provisions must be the prime compliance concern of any UAS service provider, as this is their role and they will answer directly for any issues related to the subject.

Even though the Operator's responsibilities seem to be somewhat limited, it is worth noting that the development of operational procedures has further ramifications, and that the information declared to national authorities regarding such said operation will not only influence the risk assessment but also determine the category of the operation, meaning that if the Operator does not fulfil its role accurately the outcome of potential incidents may be considered their direct responsibility or as an aggravation of mismanagement.

Furthermore, the basic role of the Operator hereby presented does not decrease, interpedently of what category the operation is classified as the responsibility of the Operator remains the same, but its liability may increase depending on the size and risk of the operation.

[180] UAS Regulation, Annex, Part A, UAS.OPEN.040 'UAS operations in subcategory A3', (1), (2), (3), (4), (5), (6), and (7).

2.2.2.2.2. SPECIFIC CATEGORY[181]

This category is considered to be medium-risk operations rules by covering more elaborate types of operations that have increased challenges in comparison to the Open category. Through a thorough assessment conduction based on a system of declaration of activities by the Operator, it indicates different requirements necessary to keep the operation safe.

In addition, to satisfy operations within the Specific category, the Operator requires an operational authorisation (to be issued by the competent authority) as well as it has to comply with the mitigating provisions of Article 12 of the UAS Regulation.

Some consider this to be the most challenging of the categories since in order to identify its application the Operator must apply for authorisations by using the "standard scenarios" provided by the UAS Regulation or, alternatively, hold a light UAS Operator certificate (LUC) that could potentially allow specific privileges. The fact that the Specific category definition parameters is set in between low and high-risk definitions means that its application will often have to be determined by the evaluation of several different aspects, in contrast with the other categories where the risk is easily assessed.

Another challenge is the Specific category characteristic of broad applications and different operational models of employability, since it can be used in a wide variety of professional and commercial scenarios through a number of alternative solutions, such as parcel delivery, surveillance, filming, inspection of infrastructures, through independent remote piloted employment or even managed through complex off-site UASs applications. As Finger, Bert and David presented in their study, the most important step for the Specific category to be materialised is the development of a technology that will allow the integration of the drones into the air traffic control system.[182] As a matter of fact, one of their predications is that in order to reap the full potential of DaaS, a system of air navigation for unmanned autonomous aircrafts needs to become available as to provide for planning and monitoring of flights paths and ensure the safe management of UAS around other vehicles and geo-fenced areas for drones[183], which may sound as simple, but similarly to other requirements imposed by these category, will be a challenge that requires operational harmonisation within the European Single Sky prior to the launch of commercial enterprises.

[181] UAS Regulation, Article 5.
[182] Matthias Finger, Nadia Bert and David Kupfer, Regulating Drones - Creating European Regulation That Is Smart and Proportionate (European University Institute 2015), 3.
[183] Ibid.

The EU Commission, recognises this issue and has already started funding research towards the development in different areas of the aviation sector, regarding the unification of the UAS airspace management the Commission has joined forces with the private sector and regional bodies in an effort to create the Single European Sky Air Traffic Management system or as it is referred by scholars, the Unmanned Traffic Management (UTM).[184]

For the purpose of giving context to the reader, these are few examples of the requirements foreseen by the Specific category:

- Where one of the requirements laid down in the Open category is not met, the UAS Operator shall be required to obtain an operational authorization[185] as well as to perform a risk assessment of the operation.[186]
- The competent authority shall specify whether the operational authorization concerns: "a) the authorization of a single operation or a number of operations specified in time or location(s) or both, such authorization must also include a precise list of mitigating measures"[187]; "b) the approval of an LUC"[188]. That said, there are exceptions: "a) where the UAS Operator submits and operational declaration of compliance with a standard scenario as defined in Appendix 1 of the Annex of the UAS regulation to the competent authority of the Member State"[189]; or if the "UAS Operator holds an LUC with appropriate privileges"[190], the operational "authorization shall not be required"[191].
- Standard Scenarios for the Specific category operations are defined in Appendix 1[192] to the UAS Regulation and are in general in compliance with the following characteristics:

"**UAS.SPEC.020**

[184] Anna Fiorentino - 'EU to Deploy UAV Traffic Management System By 2019' (Sae.org, 2018) <https://www.sae.org/news/2018/03/eu-to-deploy-uav-traffic-management-system-by-2019> accessed 23 January 2020.
[185] UAS Regulation, Article 5, 1.
[186] Ibid., Article 5, 2.
[187] Ibid., Article 5, 4, (a).
[188] Ibid., Article 5, 4, (b).
[189] UAS Regulation, Article 5, 5, (a).
[190] UAS Regulation, Annex 1, Part C, UAS.LUC.060 'Privileges of the LUC holder' (1) and (2): Such as the privilege of an LUC holder authorizing its own operations without submitting operational declaration nor need applying for an operational authorization.
[191] UAS Regulation, Article 5, 6.
[192] The Appendix with the provisions regarding standard scenarios had not yet been officially publish by the time the thesis was submitted to evaluation.

Operational declaration

(1) In accordance with Article 5, the UAS Operator may submit an operational declaration of compliance with a standard scenario as defined in Appendix 1 to this Annex to the competent authority of the Member State of operation as an alternative to points UAS.SPEC.30 and UAS.SPEC.40 in relation to operations:

(a) of unmanned aircraft with:

(i) maximum characteristic dimension up to 3 metres in visual line of sight operation (VLOS) over controlled ground area except over assemblies of people,

(ii) maximum characteristic dimension up to 1 metre in VLOS except over assemblies of people;

(iii) maximum characteristic dimension up to 1 metre in BVLOS over sparsely populated areas;

(iv) maximum characteristic dimension up to 3 metres in BVLOS over controlled ground area.

(2) A declaration of UAS Operators shall contain:

(a) administrative information about the UAS Operator;

(b) a statement that the operation satisfies the operational requirement set out in point (1) and a standard scenario as defined in Appendix 1 to the Annex;

(c) the commitment of the UAS Operator to comply with the relevant mitigation measures required for the safety of the operation, including the associated instructions for the operation, for the design of the unmanned aircraft and the competency of involved personnel.

confirmation by the UAS Operator that an appropriate insurance cover will be in place for every flight made under the declaration, if required by Union or national law."[193]

(Edited by writer)

2.2.2.2.3. CERTIFIED CATEGORY[194]

This category is considered to be high-risk operations rules, mostly because it applies to operations that may pose a threat to people (including both persons engaged in the operations and third parties) in addition to any scenarios where the competent authority, based on the assessment of Article 11 of the UAS Regulation, considers the operation to be of relevant risk after the evaluation of the operation declaration provided by the UAS Operator. The Regulation offers three clear examples: operations

[193] UAS Regulation, Annex, Part B, 'UAS Operations in the 'Specific' Category, UAS.LUC.020, 'Operational declaration', (1) and (2).
[194] UAS Regulation, Article 6.

that take place over assemblies of people[195]; the transport of people[196]; and carriage of dangerous goods that may be a threat to third parties in the event of accidents[197]. Furthermore, the operations shall be classified as "Certified" when the risk of the operation cannot be "adequately mitigated without the certification of both the UAS and Operator, as well as, where applicable, without licensing of the remote pilot."[198]

As a side not, even though the carrying of people by UAS will have to observe and respect the provisions of the Regulations (EU) 2019/945 and 2019/947, such activities are outside the scope of this thesis for posing a completely different challenge to the regulator and will not be presently explored.

In this category, where the main topic is the risk the operations poses, the subject to be explored is how the competent regulatory body will assess the mitigating risks. Consequently, what must a UAS Operator, or DaaS Provider, be prepared to declare in its report, such as the inclusion of CE marking, which aims to ensure compliance with the technical requirements for mass-produced UAS.[199] These technical requirements may seem out of focus, but they are ultimately responsible for setting the liabilities imposed to the Operators from the regulatory perspective.

In accordance with the topic, it is worth highlighting that in October 2019, the UAS operations regulation reached a major breakthrough with the publication of the Acceptable Means of Compliance (AMC)[200] and Guidance materials (GM)[201] for the UAS Regulation's categories "Specific" and "Certified", where the JARUS with the objective of "creating a methodology for conducting risk assessment for the "Specific" category, developed the "Specific Operation Risk Assessment" (SORA), clarifying compliance requirements to support the activities of UAS Operators. "Additionally, a first pre-defined risk assessment (PDRA) will assist Operators during the application

[195] UAS Regulation, Article 6, (b), i.
[196] Ibid., ii.
[197] Ibid., iii.
[198]
[199] Steven De Schrijver, 'Commercial Use Of Drones: Commercial Drones Facing Legal Turbulence: Towards A New Legal Framework In The EU' (2019) 16 US-China Law Review, 343.
[200] Executive Director Decision 2019/021/R of 9 October 2019, Recital 2: 'AMC are non-binding standards issued by EASA which may be used by persons and organizations to demonstrate compliance with Regulation 2018/1139 and the delegated and implementing acts adopted on the basis thereof'.
[201]Executive Director Decision 2019/021/R of 9 October 2019, Recital 3: 'GM is non-binding material issued by EASA which helps to illustrate the meaning of a requirement or specification and is used to support the interpretation of Regulation (EU) 2018/1139, the delegated and implementing acts adopted on the basis thereof, certification specifications and acceptable means of compliance'.

procedure for an authorization in the specific category for special UAS operations"[202], such as in BVLOS cases.

The method of evaluation of risk is quite upfront, being structured on the information provided by the Operator in its declaration. The assessment of the report shall propose a target level of safety equivalent to the safety level in manned aviation and must address the following:[203]

1. Operational risks:[204]

a. the description of the characteristics of the UAS operation;
b. a proposal of adequate operational objectives;
c. identification of risk of the operations on the ground and in the air , considering the extent of the danger posed to third parties, or properties on the ground by the UAS activity; the complexity, performance, and operational characteristics of the UAS involved; the purpose of the flight, the type UAS (class) and collisions probability; the type, scale and complexity of the UAS operation or activity; and the extent to which the persons affected by the risks in the operation are able to assess and exercise control over;
d. the identification of range of possible mitigating measures;
e. the determination of the necessary robustness of the selected mitigating measures in order to have a safe conduction of operations;

2. Description of UAS Operation:[205]

a. nature of activity to be performed, e.g. video shooting or package delivery;
b. operational environment and geographical are for intended operations;
c. complexity of the operation;
d. technical features of the UAS, including the assessment of its performance towards the declared environment;
e. the competence of the personnel conducting the operation, including: their composition role; responsibilities; training; and recent experience.

3. Risk Identification standards:[206]

a. VLOS or Beyond Visual line of sight operation (BLOS);

[202] Ibid.
[203] UAS Regulation, Article 11, 3.
[204] UAS Regulation, Article 11, 1.
[205] UAS Regulation, Article 11, 2.
[206] UAS Regulation, Article 11, 4.

b. population density regarding overflown area and if it will be flying over an assembly of people;
c. “the dimension characteristics of the Unmanned Aircraft”;
d. the unmitigated air risk of the operation considering: “the exact airspace volume, including the place where the operation is planned to take place and extended volume of airspace needed for contingency procedures; class of the airspace; impact on other air traffic and ATM, particularly the altitude of the operation, controlled versus uncontrolled airspace, aerodrome versus non-aerodrome environment, airspace over urban versus rural environment, and the separation from other traffic”.

4. Identification of Mitigating Measures[207]

a. The Operator muster consider and present a plan that addresses, the “containment measures for people on the ground”;
b. “strategic operational limitations to the UAS operation, particularly regarding restriction of the geographical volumes where the operation will take place and restriction to the duration or schedule of the time slot of the operation”;
c. strategically “mitigation by common flight rules or common airspace structure and services”, as well as, the “capability to cope with possible adverse operating conditions”; and “capability to operate with possible adverse conditions”, such as the weather;
d. organization factors, such as:
i. “operational and maintenance procedures”, both elaborated by UAS Operator and “compliant with manufacturer’s user manual”;
ii. “the level of competency and expertise of the personnel involved in the safety of the flight”;
iii. “the risk of human error in the application of the operational procedures”;
iv. “the design features and performance of the UAS”, particularly: “the availability of means to mitigate risks of collision; the availability of systems limiting the energy at impact or the frangibility of the unmanned aircraft; and the design of the UAS to recognised standards and the fail-safe design.”

These are to be interpreted as the possible ramifications of the Operator, which may further aggravate the regulatory liability that the service provider will be held against. While in the previous categories, the requirements are somewhat lower. Giving the risk implied by the Certified category the standards applied are much higher.

[207] UAS Regulation, Article 11, 5.

Regarding compliance, this is the most challenging of the three and demands a high level of understanding both from the engineering and risk assessment perspectives. The regulatory provisions are a guide to understand what needs to be assessed, but the practical knowledge for the safe conduct of Certified operations and, consequently, grant of license to conduct so will, mostly likely, depend on a multidisciplinary team. Of course, in some cases the Operator may be able to identify all the risks alone, but considering the liability risks of an incident implication, the idea of having a second party responding in a *litis consortium* (such as an insurer or a risk assessment consultant to whom the task has been delegated) is certainly worth considering, mainly as a business decision aimed at mitigating possible compensations through the sharing of responsibilities.

2.2.2.3. Cross Border Operations

The EU regulations are legal acts that apply directly at the national level, meaning that once the act is enters into force it harmonises the legislation within the Member States of the EU Single Market. That characteristic is particularly relevant for UAS commercialisation when combined with the EU's principle for the free movement of goods, as companies may be established in one MS but also conduct operations both in other MS or even crossing Member Sate's border lines on a regular basis, e.g. a surveillance company that provides DaaS for a business that has factories in more than one MS; or a DaaS Provider that is registered in a MS but intends to conduct an operation in another MS.

In order to support the business potential of UAS and in compliance with Article 61 of the Brussels I Bis Regulation, Regulation (EU) No 1215/2012 of the European Parliament and of the Council of 12 December 2012, which states "No legalisation or other similar formality shall be required for documents issued in a Member State in the context of this Regulation"[208], the UAS Regulation has implemented provisions to promote the free movement of goods and services in its Article 13. [209]

Cross-border operations are not considered to be simple operations; therefore, the minimum applicable rules are those defined under the Specific category, which denominates operations that require a regulatory approval by a MS competent authority. Since this category also imposes extensive documentation and risk evaluation the UAS regulation foresees the acceptance of a set of already issued documents and authorisations as sufficient to grant the new authorisation, trusting the

[208] Pierre Callé, Cross-Border Activities In The EU - 'Promoting The Free Movement Of Citizens And Businesses Bysimplifying The Acceptance Of Certain Public Documents Within And Outside The European Union (Proposal For A Regulation, COM (2013) 208)' (Publications Office 2015), 59.
[209] UAS Regulation, Article 13.

original Member States' autonomy, although it does allow the new application MS recipient to assess and evaluate the mitigating measures respective to its territory, since there are several regulatory requirements delegated to National Aviation Agencies regarding territorial authority supervision.[210]

[210] Ibid., 1. (a) and (b). 'a copy of the operational authorisation granted to the UAS Operator in accordance with the requirement of Article 12 of the UAS Regulation210; and the location(s) of the intended operation including the updated mitigation measures, if needed, to address those risks identified under Article 11(2)(b) which are specific to the local airspace, terrain and population characteristics and the climatic conditions' as pre-conditions to evaluate the new application.'

3. LIABILITIES

This chapter intends to present the EU framework that combines air and contract law, as well as to introduce a general notion of how it influences DaaS Providers liabilities beyond the regulatory obligation previously presented.

Through the exploration of the legal principles and regimes which both actors and contractual parties are subject to when exercising the commercialisation of UASs services, the chapter starts with the direct analysis of the EU rules that influence the sector, followed by the identification of the existing liability regimes that influence civil obligations of the legal subjects, and finally presenting the main contractual tools that can be used to mitigate potential risks.

3.1.EU FRAMEWORK FOR AIR LAW LIABILITY

In order to explore the commercial and contractual characteristics applied to UAS, it is necessary to understand how already established legal principles and jurisdiction on jurisprudence influence the application of the laws. According to the preamble of EU Regulation 2018/1139, "since unmanned aircraft also operate within the airspace alongside manned aircraft, this Regulation should cover unmanned aircraft, regardless of their operating mass."[211] In other words, considering unmanned aircrafts are conducted through airborne operations, it has been established that it qualifies as a subject of the air law framework.

Diederiks-Verschoor defends that, "air law is intertwined with other areas of law on several points", involving "many aspects of constitutional law, administrative law, civil law, commercial law, and criminal law."[212] Therefore it is not restricted to only one legal branch. Nonetheless, it is the international aspect of its application that seems to attract the most curiosity, mainly because although almost every country has a set of legal rules addressing air law, the solutions for civil liability of air carriages and for any damage that may occur to their cargo or to third parties on the ground, to the extent that the responsible flight can be identified as international, falls under "one or more multilateral treaties that set the baseline rules for the responsible carrier's liability."[213]

[211] Regulation (EU) 2018/1139 of the European Parliament and the Council of 4 July 2018, Recital 26.
[212] I. H. Philepina Diederiks-Verschoor, An Introduction To Air Law (6th edition, Kluwer Law International 2001), 1.
[213] Brian F. Havel and Gabriel S. Sanchez, The Principles and Practice of International Aviation Law (Cambridge University Press 2014), 3.

Currently, the contributing sources of air law that embody the governing rules are considered to be a combination of multilateral conventions, bilateral agreements, national laws, contracts between states and airline companies, contracts between airline companies, and the general principles of international law.[214] In an effort to harmonise those rules, EU lawmakers passed the Regulation EU 2018/1139, on common rules in the field of civil aviation, which delegates a mandate to EASA on drones and urban air mobility, extending the regulatory coverage of all drones involved in international air navigation,[215] independently of their MTOM, therefore building up the concept of a Single European Sky.

The effort towards harmonisation of air laws between the Member States is clearly needed as the current actions executed by EU law-makers have established that reaching this framework is an unquestionable target for the future of the EU Single Market, but the slow legislative process of the EU led the Member States to independently approach the matter under national jurisdiction, where each MS developed their own set of rules "mainly addressing administrative questions such as licensing or limitation of use"[216], for the purposes of public policies surrounding security and safety of individuals,[217] as a mean to engage with both the EU and international markets. The result is a fragmented collection of legislations, where depending of the territory an Operator or victim of air accident finds themselves can lead to answering to discerning applicable rules, depending on the different circumstances of the event. According to Réka, it means the focus point of the harmonisation is the establishment of the Single European Sky airspace where all involved subjects are under the scope of a unified regulation.[218]

The fact that MSs have independently developed their respective legislations on air management poses a very real challenge regarding liability and accountability for operations since, depending on who and where the damage was caused; different approaches of accountability are exercised. Usually, they follow the general rule of liability provisions,[219] where for the purpose of UASs the most

[214] I. H. Philepina Diederiks-Verschoor, An Introduction To Air Law (6th edition, Kluwer Law International 2001), 3.
[215] Commission's Communication EU about 'A new era for aviation Opening the aviation market to the civil use of remotely piloted aircraft systems in a safe and sustainable manner' (No.COM (2014)207
[216] Réka Pustahelji, 'Reflections On Civil Liability For Damages Caused By Unmanned Aircrafts' (2019) 53 Zbornik radova Pravnog fakulteta, Novi Sad, 313.
[217] Kenneth Kuhn, Small Unmanned Aerial System Certification And Traffic Management Systems (RAND corporation 2017), 8.
[218] Réka Pustahelji, 'Reflections On Civil Liability For Damages Caused By Unmanned Aircrafts' (2019) 53 Zbornik radova Pravnog fakulteta, Novi Sad, 314.
[219] See Réka Pustahelji, 'Reflections On Civil Liability For Damages Caused By Unmanned Aircrafts' (2019) 53 Zbornik radova Pravnog fakulteta, Novi Sad, 316. 'the persons who are held liable can be the producers on the basis of liability for defective products; the Operators, drivers or keepers on the basis of strict liability, or

important are strict liability and product liability. According to Davies, "there are different legal basis for the liability regimes of the Member States. In some Member States this is defined in the Civil Code (France, Romania, Czech Republic) and in others the Aviation Act – for example Denmark (Air Navigation Act, Section 127), Germany (Section 33 of the Civil Aviation Act (LuftVG)) and the United Kingdom (Section 76(2) of the Civil Aviation Act 1982). The Italian Navigation Law, Article 971 provides the legal basis for the liability regime of Italy and was extended to RPAS in Dec 2013 through a rule on *Mezzi Aerei a Pilotaggio Remoto*"[220], but not all countries have achieved a consensus on how to treat the subject, for example, according to the findings of a study conducted by Gleave, "the regulatory authorities for Belgium, the Netherlands, Spain and Sweden were unable to explain the legal basis for the RPAS liability regime in their Member State."[221]

It seems relatively simple to establish accountability regarding incidents with UASs, even more so, due the fact that air law has been practiced for many years, but the influence of the principle of proportionality provisioned in the Riga Declaration demands a review of such rules and its applications, considering in this case the subject is not a commercial airplane but rather a small vehicle and that the overregulation would make it almost impossible for the sector commercial expansion. Consequently, it is understandable that some Member States will wait for concrete cases to issue their opinions, since they will create precedents for future rulings.

3.2.LIABILITY AND INSURANCE

Another key issue to be addressed is the user liability in general. As presented in Chapter 2, the Operator is largely responsible for ensuring the conduction of activities, including the obligation to assign and warrant the pilot's certification and capacity to perform. Although that is an assumed obligation of the Operator, it doesn't exempt the pilot from all liabilities, as they are still responsible for their own obligation and will be held accountable in the event of non-compliance with its own specific requirements, such as being familiar with the user manual, holding a certificate of competency, completing online training, passing examination, and so on. The same assumption of responsibility and accountability is provisioned under the UAS Regulation, and it will be applied to all involved persons and companies linked to the Operator. Again, the Operator is almost always liable for any incidents, but it doesn't mean that they will be exclusively held accountable. For

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the person who caused the damage by their own conduct on the basis of the general rule of liability for damages.'

[220] Steer Davies Gleave, Study On The Third-Party Liability And Insurance Requirements Of Remotely Piloted Aircraft Systems (RPAS) (European Commission 2014) 23.

[221] Ibid.

example, in the event of an incident resulted from hardware malfunction for fault of manufacturer, the Operator might be served as the only respondent, but clarify that the issue was not within its power of prevention and appoint the manufacturer as the responsible, exempting itself from the claim.

De Schrijver states, "the regulatory requirements generally dictate that the Operator retains active control and supervision of the aircraft, which implies liability on the side of the Operator but technical malfunction of failures beyond the Operator's ability or control can lead to a product liability claim against manufactures."[222] Furthermore, there is always the possibility that a third-party has caused the incident, intentionally or not. This means that there are three directly possible accountable subjects and one indirectly, respectively: the pilot; the Operator; the manufacturer; and a third party. The above-mentioned information evidences the indispensable need for a harmonised international framework, since at this moment, the UAS Regulation has only made clear how the operations must be conducted but has not assigned direct liability to any party in practical scenarios, leaving far too much to be judged by the courts.

With regards to the identification of possible damaged parties, according to Réka, it is imperative to clarify that damage resulting from drone usage can be suffered by more than one subject, such as "the user, the owner himself or a third party"[223], both as injured and victim. A victim is usually entitled to compensation by the liable party, which according to Gleave, is generally defined as the party legally responsible for something, such as an action or inaction,[224] in such cases the liable parties have been identified as "the Operators, drivers, keepers, or the person who caused the damage by their own conduct"[225].

It is interesting to realize that some parties appear both as potential liable parties and victims. This is not an exclusive characteristic of the air law framework, or uncommon in civil and contractual liabilities related topics. A big part of agreement drafting is devoted exactly to the identification and imposition of defence mechanisms to avoid doubts of accountability and indemnity in the event a party finds itself as the victim or in need of answering damage compensation claims.

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[222] Steven De Schrijver, 'Commercial Use Of Drones: Commercial Drones Facing Legal Turbulence: Towards A New Legal Framework In The EU' (2019) 16 US-China Law Review, 344.
[223] Réka Pustahelji, 'Reflections On Civil Liability For Damages Caused By Unmanned Aircrafts' (2019) 53 Zbornik radova Pravnog fakulteta, Novi Sad, 316.
[224] Steer Davies Gleave, Study On The Third-Party Liability And Insurance Requirements Of Remotely Piloted Aircraft Systems (RPAS) (European Commission 2014) 21.
[225] Réka Pustahelji, 'Reflections On Civil Liability For Damages Caused By Unmanned Aircrafts' (2019) 53 Zbornik radova Pravnog fakulteta, Novi Sad, 316.

Curiously, the whole concept of the UASs legislation is risk-based, but the legislation itself does not rule on how the MSs are supposed to proceed on civil responsibilities, it also does not foresee a minimum financial compensation nor reparation limitation. It is interesting to see that even though the risk is the fundamental rule of assessment for the operations, the quantification of liabilities has not been set or evaluated by the EU legislators to provide a direction to Member States rulings. The concept of Deregulation[226] does indeed need to be taken under consideration in this case, as well as the Principle of Primacy, but creating guidelines don't seem to challenge either.

One of the main issues regarding civil responsibilities faced by those trying to commercialise the technology is exactly the lack of a "uniform liability framework for drones in the EU"[227] since "businesses must look at the domestic liability systems, which differs from fault-based to strict (i.e., no fault or negligence has to be proven) and from limited to unlimited liability"[228], but need to be able to operate their business across the EU Single Market.

Furthermore, mentioning that the identification of the possible liable parties is a requirement for the conductions of DaaS is a valid concern, since the only way to understand the risk a company or person is exposed to, is through the correct assessment of its own role and respective responsibility in the operations. The result of such assessment will serve as basis for the judgement of both the courts and the insurance companies, the first aiming at quantifying compensation and the later to calculate the costs arising from potential liability coverage. Also, even though a party may be insured, it doesn't mean the responsibility is passed towards the insurance company, the liable party continues to answer for its actions, hence, if a compensation is higher than the premium of the contracted insurance, the liable party still needs to indemnify the victim for the correspondent damage that supersedes the contractual coverage, and in order to be able to grow they require further understanding of how much the exceeding figure can be.

Examples of the potential liability issues to be faced by the commercialization of drones' services include damage to "person, land, or property of another"[229]. Given the current technological development stage of RPAs and UASs, there are still many risks resulting from their own hardware

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227 Steven De Schrijver, 'Commercial Use Of Drones: Commercial Drones Facing Legal Turbulence: Towards A New Legal Framework In The EU' (2019) 16 US-China Law Review, 345.

228 Ibid.

229 'Tort Law: Strict Liability And Abnormally Dangerous Activities' (Lawshelf.com, 2020) <https://lawshelf.com/shortvideoscontentview/strict-liability-in-tort-law> accessed 17 February 2020.

and software limitations, which aligned with the conditions for operations, including flying and free falling from high altitudes, pose a significant threat to those both involved and uninvolved.

National courts under the General Principle of Tort Liability, more specifically the strict liability principle, usually address these potential threats. It is conceptualisation of the principle is based on foreseeing that some commercial activities may pose a significant higher risk and therefore whoever caused it, independently of proof of carelessness or fault, shall compensate the victim of the potential harm.

That said, there are certain exceptions to strict liability, such as Act of God, Wrongful Act of a Third Party, and Plaintiff's Own Fault. The first, relates to "sudden, direct and irresistible acts of nature that"[230] no one can reasonably prepare for; the second is subject to the action of a third party, not involved in in the agreement but that has caused the incident; and the last, means when someone has caused the damage themselves, resulting in the impossibility of claiming damage compensation from neither involved or non-involved persons.

Still under strict liability, it is possible to encounter another rule, the Rule of Absolute Liability, when none of the exceptions are accepted. This rule focus on the fact that some activities may pose such hazardous consequences that a party may be forced to compensate a victim for damages, independently of fault or guilt, for example: if an Operator has completed all the necessary assessments and conducted the operation in accordance with the mitigating measures plan but the operation still resulted in extremely harmful consequence (such as accidently contaminating a river that supplies a city with water, during the exercise of a delivery), the victims deserve to be compensated by whomever caused the incident, intentionally or not. This example also has an administrative personality, since events that pose a threat to the public dominium fall under competence of the State and are independent of contractual agreements terms.

Although not all Member States apply strict liability to the same extent, there are some activities that are usually universally labelled as fitting for such treatment; the most notable is the transportation of flammable and toxic materials. According to the article by Lawshelf[231], "it should be noted that the damages need not necessarily to include only damages normally anticipated and associated with the

[230] 'Rule Of Strict Liability: Rule Of Absolute Liability, Questions' (Toppr-guides, 2020) <https://www.toppr.com/guides/legal-aptitude/law-of-torts/the-rule-of-strict-liability/> accessed 17 February 2020.

[231] 'Tort Law: Strict Liability And Abnormally Dangerous Activities' (Lawshelf.com, 2020) <https://lawshelf.com/shortvideoscontentview/strict-liability-in-tort-law> accessed 17 February 2020.

dangerous activity. Damages also need not be limited to physical injury. They can include emotional pain and even loss of business profits."[232]

Another potential liability is the risk to privacy and cyber security laws, where drones that operate with image collection may end up breaching the warranties provided by the rule makers, such as personal data - safeguarded by Regulation (EU) 2016/679 (GDPR); or being subject to malware intended to steal data, or even hacking and high jacking for the purposes of carrying out wrongful or illegal activities.[233]

Besides the above-mentioned liabilities, where an incident may be caused due to non-compliance, operational mistakes and in some cases outside interference, there is also the potential risk caused by failure in consequence of defective products. In this scenario, also characterized as Product Liability, the scope of the liability is addressed by the EU in "Directive 85/374/EEC of 25 July 1985, on the approximation of the laws, regulations and administrative provisions of the Member States concerning liability for defective products"[234], and is directly connected to the CE (*Conformité Européene*) marking requirements set by Regulation (EU) 2019/945[235] and Regulation (EC) No 765/2008 and the manufacturer's ability to comply with it.

It would be expected that after so many years of commercial manned aircraft exercise, the international community would have come to a global framework on how to proceed about third-party liability claims, but that is not the case. There seems to be a global understanding that the applicable legislation is based on the place where the victims live, where the service was contracted, or where the damages to the surface have occurred, meaning that the civil liability regime to be applied can often be disputed. The assumption that the jurisdiction is assigned by the place where the fact occurred is ancient and almost undisputed truth (in Latin it is defined as *lex loci,* for example*)*, but the present challenge is here is that the States have not come to an agreement regarding principles that reign civil responsibilities litigation resulted of air borne incidents. So far, a few countries have agreed on the terms of the Rome Convention of 1952 "Convention on Damage Caused by Foreign Aircraft to Third parties on the Surface"[236], but even the countries that ratified it have not

[232] Ibid.
[233] Steven De Schrijver, 'Commercial Use Of Drones: Commercial Drones Facing Legal Turbulence: Towards A New Legal Framework In The EU' (2019) 16 US-China Law Review, 345.
[234] Council Directive 85/374/EEC of 25 July 1985 on the approximation of the laws, regulations and administrative provisions of the Member States concerning liability for defective products.
[235] Regulation (EU) 2019/945, Section 2, Article 6 – 'Obligations of manufacturers'.
[236] Convention on damage caused by foreign aircraft to third parties on the surface. (Signed at Rome, on 7 October 1952) (Rome Convention)

implemented the Protocol, with the two main reasons for avoiding to do so being that the limits for compensation set under the Rome Convention are considered lower in comparison to the limits currently imposed by the State's domestic laws; and that it only foresees one jurisdiction (namely the State where the damage occurred, unless agreed otherwise between the parties).

For the benefit of future legislators, the Rome Convention[237] has elected the principle of strict liability, with a few exceptions in its Article 5, including any damage that is caused as a "direct consequence of armed conflict or civil disturbance, or if such person has been deprived of the use of the aircraft by act of public authority"[238], it has also proposed a capped liability compensation, "with parallel compulsory insurance by the liable party, up to the limit of the liability"[239]. Even though States have not enforced the Rome convention itself, they have a familiar way of interpreting the subject, Masutti and Tomasello, believe that this is a consequence of the ratification of other agreements that have similar provisions, such as the "International Convention of Civil Liability for Oil Pollution Damage (CLC), the International Convention on the Establishment of an International Fund for Compensation for Oil Pollution Damage (FUND), or the Vienna Convention on Civil Liability for Nuclear Damage"[240].

In reality there is only one harmonised regulation within the EU Member States, Regulation 785/2004 on insurance obligations for civil liability of the Operator for damage to third party. That said, the Regulation provisions are limited to the introduction of a compulsory insurance system, resulting in the lack of regulatory specifications regarding for example: the third-party liability regime, the identification of the liable party, the eligible damage, and other necessary clarifications on a number of related topics.

Finally, it has been extensively presented that there are a number of parties that can find themselves in countless alternative situations in which understanding their position is essential towards risk assessment and protective measures planning. Both the European Commission[241] and the Riga

[237] Convention on damage caused by foreign aircraft to third parties on the surface. (Signed at Rome, on 7 October 1952) (Rome Convention)
[238] Convention on damage caused by foreign aircraft to third parties on the surface. Signed at Rome, on 7 October 1952. (Rome Convention).
[239] Anna Masutti and Filippo Tomasello, 'International Regulation Of Non-Military Drones' (1st edition, Edward Elgar Publishing 2018) 174.
[240] Ibid.
[241] Ibid., 'After having described all the significant issues for safe and sustainable development of the drone market, the European Commission identifies, six actions for the complete integration of drones in the common airspace and remains ultimately responsible for the implementation of such actions.', 171.

Declaration[242] have also foreseen this subject as one of great importance, mostly because together they identify the requirement for a balanced proportional liability framework, where both the investor and civilians can understand and feel safe in its respective endeavours.

The longer the framework for liabilities takes to be created, the harder the consolidation of UASs as commercial ventures will take. It is possible to identify a cascade reaction to the topic, where the lack of a consolidated regime application, prevents the Operators from quantifying their operational risks, which in turn, will prevent insurance companies from calculating the coverage of their products, therefore the manufactures will be unable to negotiate indemnity towards the Operator, since the later has no way of knowing how much they might have to compensate beyond the insurance premium or faulty devices claims.

This chapter has presented the current situation of liabilities analysed from the existing legislation, but it is fair to assume that presently the regimes to be applied in the EU will be defined by the either the identification of the place of incident or by agreed choice of jurisdiction between parties. Although, most times, it is an easy identification process, when there is more than one conclusive choice, there can be several different ways of electing a jurisdiction, for example: it can be where the fact took place, where the service was contracted, where the supplier is based, where the customer is based, or as contractually agreed between the parties, all varying depending on the nature of the incident and involved parties.

3.3.CONTRACTUAL LIABILITY

Now that the regulatory framework, the principles of liabilities under air law for liability assignment, and the current applicable liability regimes have been explained, it is possible to investigate the layout in which potential business ventures can expect, such as the aspects and the current contractual tools (including the freedom to contract, the choice of law jurisdiction and the management of contracts between parties from different countries) that might influence liability assignment in mutual agreements between counterparties that intend to explore DaaS.

Legally, the prevailing assignment of liability to Operators has been quite clearly expressed under the regulatory and air law, but the regime to be applied may depend on the competent jurisdiction and

[242] Riga Declaration on Remotely Piloted Aircraft (drones) 'Framing the Future of Aviation', Latvian presidency of the Council of the European Union, Riga (2015), 5.

contractual terms. That remark leads to another aspect of this thesis, which is the relevance of choice of law and jurisdiction in services agreements, more specifically the contracts for DaaS agreements.

Traditionally, cloud-based agreements tend to be presented as fixed templates, where the provider most likely opts for the jurisdiction where the company establishes its headquarters or, alternatively, where their legal representation has its offices. The logic behind that practice lies on the fact that the cost of proceedings are usually lower, considering documents won't require official translations, the employees will be able to deal with agencies requests more comfortably and, although controversial, in some cases national courts may act favourably towards companies that bring in investments to domestic economies.

Commonly, the above-mentioned examples are used to decide the law and jurisdiction of a contract, but another relevant aspect to be considered for DaaS is the jurisprudence being applied under air law by the competent tribunals. Since DaaS is inspired by the air law regulations, it is understandable that while taking under account the principles set by the Riga Convention, the courts will initially base their decisions regarding application of liability regime in a similar manner to how they have ruled in cases of airline Operators. Therefore, by using them as reference a party may opt to have the contract executed under a friendlier jurisdiction towards Operators, where the liabilities compensations would not be as strict as in their home State.

If both DaaS Provider and customer are based in the same jurisdiction there shouldn't be many challenges with accepting such terms, but due to the nature of DaaS being an internet-based service to be operated in a cross-country format, it is highly likely that the parties to the agreement will have distinct origins, which will lead to the negotiation of the applicable laws and jurisdiction clause.

According to Rutgers and Sirena[243], the reference for parties' autonomy to negotiate the contractual clauses is found on the proposed Common European Sales Law (CESL)[244], which introduces both "general principles"[245] and "underlying principles"[246] in its provisions. It is understood by the

[243] Salvatore Patti, 'Contractual Autonomy and European Private Law' in Jacobien Rutgers and Pietro Sirena (eds), Rules and Principles in European Contract Law (Intersentia Ltd 2015), 124.
[244] Proposal for a Regulation of the European Parliament and of The Council on a Common European Sales Law/ COM/2011/0635 final - 2011/0284 (COD)
[245] Ibid., Annex I, Part I, ''introductory provisions' sets out the general principles of contract law which all parties need to observe in their dealings, such as good faith and fair dealing. The principle of freedom of contract also assures parties that, unless rules are explicitly designated as mandatory, for example rules of consumer protection, they can deviate from the rules of the Common European Sales Law.'
[246] Ibid., Annex II, Recital (29).

Commission as "to denote essentially abstract values"[247], presenting the idea the "justice, freedom, protection of human rights, promotion of the internal market, legal certainty, and rationality"[248] as necessary for the validity of a fair agreement. Later, the Principles of European Contract Law were updated to appoint the "guiding principles"[249], which were built under "around three pillars: freedom of contract, contractual fairness and contractual certainty"[250].

The relevance of freedom of contract can be observed in the CESL Article 1, paragraph 1, which states "Parties are free to conclude a contract and to determine its contents, subject to any applicable mandatory rules"[251] and consequently serves as base for the Regulation (EC) No 593/2008, "on the law applicable to contractual obligation"[252], which in return references the principle in Article 3 "A contract shall be governed by the law chosen by the parties. ... By their choice the parties can select the law applicable to the whole or to part only of the contract." The Regulation further establishes provisions in the event of the absence of choice of law, which is worth highlighting due to the nature of DaaS being easily exercised both by companies and private individuals as services providers. In such cases, the Regulation identifies that "a contract for the provisions of services shall be governed by the law of the country where the service ice provider has his habitual residence"[253].

Even though the parties are free to choose the applicable law to the terms of the contract, there are certain exceptions to applicability that may override the decision. In Article 9 of the Regulation the regulator foresees such exceptions as matters that "are regarded as crucial by a country for safeguarding its public interest, such as political, social or economic", as well as the defence of the application of "mandatory provisions of the law of the forum" and legal and regulatory obligations arising from the execution of the contract in the place of origin. In other words, even though the parties may chose the applicable law of the contract, in some cases the local law must be applied

[247] Draft Common Frame of Reference 2008, n.1 above, Introduction, para 11, p. 9.
[248] Ibid. Para 22, p. 13.
[249] Proposal for a Regulation of the European Parliament and of The Council on a Common European Sales Law/ COM/2011/0635 final - 2011/0284 (COD), Annex II, Recital (30). 'Freedom of contract should be the guiding principle underlying the Common European Sales Law. Party autonomy should be restricted only where and to the extent that this is indispensable, in particular for reasons of consumer protection. Where such a necessity exists, the mandatory nature of the rules in question should be clearly indicated.'
[250] Jacobien W Rutgers and Pietro Sirena, Rules and Principles in European Contract Law (Intersentia Ltd 2015), 101.
[251] Proposal for a Regulation of the European Parliament and of The Council on a Common European Sales Law/ COM/2011/0635 final - 201).1/0284 (COD), Part I, Chapter I, Section1, Article 1, 'Freedom of contract'.
[252] Regulation (EC) No 593/2008 of the European Parliament and of the Council of 17 June 2008 on the law applicable to contractual obligations (Rome I), Article 3.
[253] Ibid., Article 4, (b).

regardless, one example of such application is environmental damages that can potentially result from of accidents involving the carriage of dangerous goods and liability for nuclear waste damages.[254]

Although the choice of law has a significant impact in the way a contract is to be interpreted by the courts the choice of jurisdiction is equally important, since the competent courts are the ones actually deciding how to enforce and which regime will be applicable. Regarding that matter the Shiu and Hutt refer to the ""Recast" Brussels (EU 1215/2012), the Rome I (EC 593/2008) and the Rome II (EC 864/2007) Regulations" [255]; altogether aimed at establishing the governing law rules and disputes concerning applicable contract jurisdictions in the European Union. Another important piece of legislation that needs to be considered is the "Hague Convention of 30 June 2005 on Choice of Court Agreements, signed by the EU in 2009"[256], which allows for contracting parties that meet the requirements of the Hague Convention[257], to designate and elect the courts of a Contracting State, or to exclude one or more specific courts of a Contracting State. That said, the abovementioned legislation references address the option to choose State courts and do not refer to the use of arbitration.

Arbitration is another resource that can be applied to international contracts, but it depends on the recognition of State's acceptance to the practice, meaning that even if the parties have agreed to its use, the enforcement of prizes will be subject to the domestic courts where the execution is due.

Considering the parties have the option to choose the applicable law and the competent court to judge over any disputes, including the possibility to appoint different laws and courts to judge specific terms of the contract, as well as the differing decisions previously applied towards indemnities ruling in the past, the relevance of negotiating the these terms becomes very clear.

In business, every coin must be accounted for, as well as every risk must be predicted and insured in order to safeguard its survival. Through the election of certain State's law in combination to the jurisdiction a party may be able to estimate possible costs, therefore enabling investors and insurance

[254] Hague Convention on Choice of Court Agreements of 30 June 2005 (Hague Convention), Article 2, f) and i).
[255] Ivan Shiu, and Giles Hutt, 'Jurisdiction And Governing Law Rules In The European Union' 2016 (Hogan Lovells 2016) <https://www.hoganlovells.com/~/media/hogan-lovells/pdf/2017-general-pdfs/jurisdiction-and-governing-law-rules-in-the-european-union-2016.pdf> accessed 26 March 2020.
[256] 'Choice Of Court Convention: EU Businesses Receive A Major Boost For International Trade' (European Commission - Europa, 2020) <https://ec.europa.eu/commission/presscorner/detail/en/IP_14_1110> accessed 28 March 2020.
[257] Hague Convention on Choice of Court Agreements of 30 June 2005 (Hague Convention)

companies to deposit a higher level of trust in the business. Such decisions may be useful to prepare for possible contractual disputes, but they are not the only ones.

Another available tool for a DaaS Provider, and possibly the most valuable regarding liability and indemnity disputes, is the possibility to predetermine limits to the compensation, commonly called "caps".

Commercial transactions always carry a certain risk of liability, it can concern breach of contract, negligence, misrepresentation, infringement of intellectual propriety, regulatory offences, defamation, and more. Without setting a limit in the terms of the agreement, a party may be completely unprotected from claims that may largely extrapolate the value of the offered services. For those reasons, it is important for both the DaaS Provider and the customer to effectively agree on these limitations, guaranteeing that they are both effective and enforceable.

In order to achieve an agreement, the DaaS Provider must consider the identification of risks; ways of minimising them, insurance options, and decide which liabilities to exclude, cap, or accept. Quite often a party may choose to opt for different levels of liability towards individual obligations set in the contract. The most common sought after exclusions by suppliers are, for example, "loss of profits, loss of sales or business, loss of contracts, loss of anticipated savings, loss of data and loss of goodwill"[258], while the most commonly accepted are liabilities for "fraud, death, and injury caused by negligence"[259], as well as for losses within its exclusive control, usually by giving indemnity against those losses.

Giving the nature of DaaS and, more specifically, the possibility of performance of contract under a subscription model, the Operator might also resort to different alternatives that may present better alternatives, such as applying a single figure for the duration of the contract, an annual cap that renews with the contract, amounts linked to the sums paid under the contract, or even limit to the total value of the contract itself. Furthermore, the caps may be applied to each claim or to a series of connected claims.

Alternatively, the parties can resort to drafting methods to build a contract that better reflects the execution of the business relationship, through the use of non-reliance wording to avoid

[258] McDowell Purcell, 'Commercial Contract Issues: Limiting Your Liability' (Fieldfisher, 2016) <https://www.fieldfisher.com/en-ie/locations/ireland/ireland-blog/commercial-contract-issues-limiting-liability> accessed 28 March 2020.
[259] Ibid.

misinterpretation; limitation of party's obligations or duties; limitation of rights; exclusion of implied terms; force majeure terms; termination provisions; imposition of preconditions to claims; claims limitations; remedies; need of conclusive evidences; demand of insurance coverage of the counterparty; and finally, the utilization of "risk allocation regardless of fault"[260], which can be applied strategically between the parties, such as if a party has indemnity claims towards a manufacturer or insurance coverage and the other doesn't.

Finally, as Doran states, "limits on liability are commonplace in international contracting"[261], therefore when negotiating those limits, that parties should observe the value of the contract, each other's role, and potential risks if things derail from the original plan. Set caps might provide greater certainty, but not be appropriate depending on the extension of the service being provided, or if the scope might change significantly.

[260] Ibid.

[261] Katherine Doran, 'How To Successfully Limit Your Contractual Liability' (Lexology.com, 2017) <https://www.lexology.com/library/detail.aspx?g=61ae2faf-9fda-460a-b13b-0d8dbf724453> accessed 28 March 2020.

4. CONCLUSION

Drones-as-a-Service have a variety of commercial applications, and the sector will clearly observe an investment increase in the near future. The most effective way of promoting the dissemination of such business will be through the utilisation of cloud-based services contracts, but in order to reach that phase, the Operators will have to observe and comply with the UAS Regulation[262] provisions and understand their own legal obligations prior, during and after operations, as well as the identification of the different liabilities that each phase involve. Furthermore, anyone that intends to venture into the business will also have to observe and strategize on how to optimize the risks under a business plan.

Even though drones started as military ventures, nowadays the civil applications justify the dissemination of the technology under an updated technical platform which will allow both individuals and companies to explore the business opportunities that are already arising in the society.

By introducing a risk-based assessment format, the UAS Regulation has provisioned both engineering and operational requirements for the carrying of drones related activities. More interestingly, it has also designated roles and assigned responsibilities (both rights and obligations) to those intending to engage in operating, flying or controlling, and manufacturing drones, as well as other devices to support different types of unmanned aircraft operations (such as UAVs and GCS).

Due to its nature and capability of being simultaneously implemented and provided on a cloud-based format, the idea of a Drone-as-a-Service platform has been presented as an ideal solution to optimize the business costs involved in the novelty venture. Through the offering of "tailored to need" and "pay-per-usage" tools, the DaaS Provider is allowed to serve a diverse number of clients in several different territories by using the same product, while the customer has the option of hiring and paying only for the tools that they require, managing to avoid extra expenses commonly present in alternatives business models. Nonetheless, the combination of the UAS Regulation provisions with the usual contractual term of Cloud-Based services agreement results in an innovative approach to business, considering that even though the services are supposedly operated through the Internet, the actual operations will take place under the Single European Sky, which demands the observance of international air law for matters such as MS regulatory provisions, competent jurisdiction for disputes, civil responsibility, and liability assignment.

[262] Implemented Regulation (EU) 2019/947 of the European Commission of 24 May 2019 on the rules and procedures for the operation of unmanned aircraft.

For the an UAS Operator or DaaS Provider, the liabilities involved in the operations are largely important for business purposes, since they can have a significant financial impact on daily activities, sometimes even being capable of dragging a party towards bankruptcy. Therefore, it is essential for them to be able to identify and foresee the costs, as well as for insurance companies that will be active in this new business model.

The UAS Regulation stipulates that the Operator is often the direct liable party for any claims that arise out of incidents and accidents caused during the performance of operations, but in view of the operations being airborne the jurisprudence available for application of liability regimes has been established under a combination of domestic interpretation of international treaties, where MSs national rulings address cases of incidents related to international air law that have taken place in domestic territory. In turn, international air law is not harmonised by the EU, meaning that air law interpretation varies according the individual sets of ratified international conventions by each MS, resulting in fragmented decisions that do not provide enough warranties for the Operators anticipation of possible hidden costs.

Regarding liabilities that arise from territorial air law regulatory incidents, there is not much the Operator can do about it, as they fall under the exceptions that are not covered by contractual agreements between parties to the service agreement; alternatively, the Operator may be able to insure its liabilities. That said, for matters which can be settled under the contractually agreed law and jurisdiction, the Operator has the possibility to try to contend the potential damages through the negotiations of the contractual clauses.

In cases where the relevant terms can be agreed, the Operator will have the chance to opt for laws and jurisdictions where it can find a lighter application of liability regimes or where it will be easier to asses regulatory impositions and civil responsibility claims, having as primordial choice, those States that already have established domestic jurisprudence related to the topic.

5. RECOMMENDATIONS

Until the harmonisation of air law is implemented in the EU there is no certain way of knowing or predicting the outcome of liability claims, which leads the author to propose three solution: (1) for the benefit of the injured parties resulted from accidents there should be created a Minimum-Harmonisation Directive stipulating minimum compensation; (2) for the benefit of the Operator and business actors there should be issued a Recommendation of potential compensation prizes in accordance with the proposed mitigating scenarios provisioned in Regulations (EU) 2019/945 and 2019/947; and (3) for the benefit and public reassurance, the establishment of a fund for possible compensation of incidents where the DaaS provider has no means of securing such payments for third-party victims.

The first recommendation concerns the EU legislative operational methods as a supranational organization. Where in the past the harmonization of international air laws by Member Stets has been hampered by the fact that MSs have opted for more strict policies, the idea of having a mandatory minimum compensation system frame, opposed to a maximum alternative, will potentially solve the public and private sector concerns.

For the national legislators, the idea of having a minimum requirement, which can be achieved through a Minimum-Harmonization Directive provisions, allows for the implementation of they consider to be the most appropriate method without harming competitiveness within the EU or possible injured parties. Such Directive would pose a base for determination, rather than impose a limitation of autonomy, therefore respecting the rule of law and promoting business.

Regarding the private sector, the Directive would grant predictability for operators and insurers, even though they would not have a limitation on possible maximum compensations allowed, it would provide a starting point for evaluations and business risk assessment.

The second recommendation follows an approach already chosen by the legislators, where in order to exemplify the categories classification, they have opted to issue standard scenarios[263] platform to

[263] Currently the standard scenarios have only been published as an opinion by the EASA (Opinion 05/2019 on Standard scenarios for UAS Operations in the ‘specific’ category) and presents the status of ‘pending’ to be transformed in a legislative act by the EU Commission and further adoption after positive vote by the EU Member States.

be interpreted in combination with the provisions of the Regulations[264], with the objective of "increasing the cost-effectiveness for drone operators, manufacturers and competent authorities, and to improve the harmonisation of drone operations throughout Europe."[265] Although this seems to be in contrast with the first solution, the objective is not to impose a mandatory limitation on compensation of liability claims but rather a material to provide assurance to both State and commercial actors. Therefore, the establishment of a minimum Directive is still possible.

So far, the idea of compensation by accidents of Unmanned Aircrafts has been framed under air law definitions, but by observing the "principle of proportionality"[266] of the Riga Declaration, it is fair to assume that some sort of guideline will be welcomed by the industry. Since the scenarios have already been drafted, why not propose a similar approach to civil responsibilities.

Which brings to the third, and final, recommendation. The creation of a fund for third-party victims of UAS related incidents, to be fuelled by mandatory contributions by Operators. Different from the currently existing insurance scenarios for air law, where the aim is to create limitations on compensations, this fund would follow a similar approach to the EU compulsory car insurance Directive.[267] Both cars and drones are bound to be involved in accidents, but it doesn't mean all vehicles will. The idea of a compulsory insurance certainly allows for at least some sort of safety for the uninvolved persons.

Similarly, to Directive 2009/103/EC, the UAS compulsory insurance would be adapted towards UAS vehicles, the new Directive proposal would address regulatory questions as follows:

"This directive

- obliges all **UAVs**[268] in the EU to be covered by compulsory third party insurance

[264] Implemented Regulation (EU) 2019/947 of the European Commission of 24 May 2019 on the rules and procedures for the operation of unmanned aircraft; and Delegated Regulation (EU) 2019/945 of the European Commission of 12 March 2019 on Unmanned Aircraft Systems and on third-country Operators of Unmanned Aircraft Systems.
[265] 'EASA Publishes Opinion 'Standard Scenarios For UAS Operations In The 'Specific' Category' | | EASA' (EASA, 2020) <https://www.easa.europa.eu/newsroom-and-events/news/easa-publishes-opinion-%E2%80%9Cstandard-scenarios-uas-operations-%E2%80%98specific%E2%80%99> accessed 19 April 2020.
[266] Riga Declaration on Remotely Piloted Aircraft (drones) 'Framing the Future of Aviation', Latvian presidency of the Council of the European Union, Riga (2015), 1.
[267] Directive 2009/103/EC of the European Parliament and of the Council of 16 September 2009 relating to insurance against civil liability in respect of the use of motor vehicles, and the enforcement of the obligation to insure against such liability.
[268] UAVs mean Unmanned Aircraft Vehicles.

- abolishes border checks on insurance, so that **UAVs** can be **remotely piloted** as easily between EU countries as within one country
- specifies minimum third-party liability insurance cover in EU countries
- specifies exempt persons and authorities responsible for compensation
- introduces a mechanism to compensate local victims of accidents caused by **UAVs registered in** another EU country
- requires claims about accidents in an EU country other than the victim's country of residence to be settled quickly (so-called visiting victims)
- entitles policy holders to request a statement of any claims involving their **UAVs**, which were covered by their insurance contract, over the last 5 years

The directive does not regulate

- issues of civil liability and the calculation of compensation awards – these are decided by individual EU countries
- optional or so-called comprehensive cover (material damage to **UAV** vehicles, vehicle theft, etc)" [269]

(Edited by writer)

As presented, this alternative allows for both the implementation of both previous recommended Directives, as well as it fits within Riga's Declaration principles. More importantly, it provides an already established framework that can be easily replicated through and adaptation process. The technology might be a novel, but it has been proven again and again that many new legislator provisions can benefit from the inspiration provided by already effective texts.

Hopefully, the legislator will be able to see the benefits in these three recommendations when drafting an alternative regarding the future of the commercialisation of drones, as these proposed measures both take under account the social benefits to Member States and to potential commercial ventures. Through the further legislation on the matter and the creation of a safety mechanism for potential damages.

[269] 'Motor Insurance' (European Commission - European Commission, 2020) <https://ec.europa.eu/info/business-economy-euro/banking-and-finance/insurance-and-pensions/motor-insurance_en> accessed 19 April 2020.

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